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Engineering News-Record

Applying asphalt plank to welded interlocking-channel floor on the new Reading Company crossing of the Susquehanna River in Pennsylvania, the first railroad bridge with a solid steel deck

Sewage Treatment calls for BYERS WROUGHT IRON PIPE

SEWAGE treatment is one of the many services where wrought iron is the engineer's choice. The reason is quite plain. Sewage treatment is highly corrosive. Hydrogen sulphide, oxygen and salts in solution are always present. This combination rapidly corrodes ordinary ferrous metals. But not so with wrought iron, which has proved its durability for many applications in Sewage Treatment Plants.

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Toward PWA Expansion

WITHIN the last week the news reports of one day threw significant light upon the prospects of a continuing public works program.

In the first place, Secretary Ickes reported that PWA construction jobs now are helping about 7,000,000 persons, many of whom might otherwise have to apply for direct relief. He underlines the fact, so often repeated in these pages during the last few years, that the effects of a PWA project extend far beyond the field employment on the job. Some 2,000,000 are directly employed on the projects. This estimate is based on the field reports of engineer-inspectors on the various jobs and covers only construction projects, disregarding entirely other channels through which PWA funds have been disbursed. It is estimated, on a one-to-one basis, that 2,000,000 more are engaged in "behind-the-lines" employment in quarries, mills and factories. The remainder of the 7,000,000 persons who benefit by the program are the dependents of those thus employed either directly or indirectly.

In the news of the same day a second item announces the appointment of Marriner S. Eccles of Utah to the post of Governor of the Federal Reserve Board. Mr. Eccles is a successful banker who has consistently advocated public works as part of a program for industrial recovery. As he puts it in a newspaper interview, "when private industry fails to put people to work you are faced with the alternative of putting them on the dole and getting no service or of placing them on public works and stimulating private business, perhaps with subsidies."

In his influential position Mr. Eccles will have an opportunity to enlist the cooperation of the Treasury and the Federal Reserve Board in behalf of the recovery program. His convictions on the subject of public investment as a stimulant to recovery will assure a sympathetic attitude on the part of the financial arm of the government.

Furthermore, in the news of the same day we find more evidence of distrust in direct relief. Day by day we see more plainly that somehow we must provide for actual reemployment, preferably through private industry but, if necessary, by way of public investment in public projects.

For example, Harry L. Hopkins, Federal Relief Administrator, says "I know of no one who is at all familiar with the problem of unemployment relief who believes that the present system should be continued a day longer than is necessary—not because it is a waste of public funds but rather that it is a tragic waste of human values and a totally un-American way of meeting the problem."

Mr. Hopkins is but one of the leaders of public thought who have recently warned us against the danger of prolonging indefinitely a policy of direct relief instead of stimulating normal employment.

Finally, after a survey of the new Congress, the Associated Press reports in the same day's news that expansion of the PWA is favored by 64 per cent of the new Congress, opposed by only 3 per cent, with but 33 per cent noncommittal. This survey covered eleven specific subjects that must have serious consideration by Congress, and of all these, that of PWA expansion showed the highest percentage favorable, the lowest percentage opposed and next to the lowest noncommittal.

All of which helps to indicate a marked trend toward a continuation of the public works program. From now on our chief concern must be to insure that such a program is administered with due regard to sound planning, normal methods, economical operation and assured continuity. Intelligent care on these points will help a national public works program to justify the faith of those who advocate it and to take its part in the further progress of national recovery.

Willard Chevalier

ENGINEERING NEWS-RECORD

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In the News:

A FORTY-HOUR WORK WEEK for state and federal highway operations, in place of the thirty-hour week now required, was recommended at the annual meeting of the American Association of State Highway Officials at Santa Fe last week.

CONSTRUCTION OPERATIONS on San Gabriel Dam No. 1 have been shut down for a 120-day period, by agreement between the Los Angeles County supervisors and the contractors, to permit restudy and possible modifications in design and specifications for this record-breaking rock-fill structure.

ESTABLISHMENT of a permanent national planning board has been recommended by the temporary national planning board in its report dated Aug. 1, released by the White House last week.

THE HOME-BUILDING and home-modernization program promoted by the Federal Housing Act is looked upon as an important factor in accelerating business recovery, in the opinion of Henry I. Harriman, president of the U. S. Chamber of Commerce.

OF THE 28 CONTRACTING FIRMS submitting bids to the U. S. Engineers for the construction of the first dam in the Muskingum Valley conservancy program ($387,450 low), 26 of the offers contained minor errors or omissions that might have constituted technical grounds for questioning the award of contract.

In This Issue:

FOR THE FIRST TIME a welded steel deck of interlocking-channel type covered with asphalt plank has been used as the floor on a railroad bridge. On a new crossing of the Reading lines over the Susquehanna River this type of design effected a dead-load reduction of 1,600 lb. per linear-foot for the nine 157-ft. truss spans. The railroad roadbed is completed by placing ballast and track on the asphalt planking.

CONTINUING the series on "Advice for Contractors Entering Government Work," chapter four discusses unforeseeable causes of delay and the possibilities of securing extension of the contract time.

PROBLEMS common to photo-elastic model study are greatly reduced by a machine developed at Princeton, which centralizes the control over all operations.

FROM THE MASS OF DATA developed during the three years of cement and concrete investigations that have formed one phase of the Boulder Dam project, the basic information is presented. The article uses an extensive series of curves to indicate the various characteristics and properties, and the text consists mainly of an explanation of these graphic presentations.

REPORT of a three-year study of the effect of cement composition on the properties of concretes, made by the Portland Cement Association, was given at the annual meeting of the American Society for Testing Materials. The current trend toward special cements enhances the value of the results to every concrete user. The report is abstracted in this issue.

AS A THIRD ARTICLE in the group that has reviewed present advance in various phases of highway design and construction, the current discussion covers bituminous roads. The advances in the art of using bituminous material for highway surfacing are found encouraging but incomplete.

PRESENT DISCUSSION of a nationwide grade-crossing separation program tends to emphasize the Wisconsin statewide plan that has eliminated 76 crossings during the last three years. An article reviews this emergency relief program as to organization and working procedure.

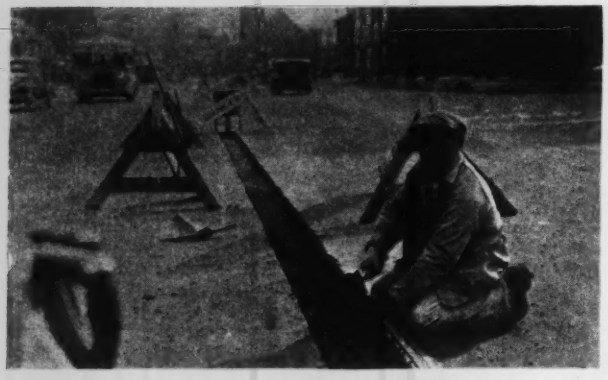
THE SCANT INFORMATION that has reached this country on the Japanese typhoon of Sept. 21 is supplemented and expanded with technical data in an article by an engineer in the public-works office at Tokyo.

NEXT WEEK: FEDERAL PROJECTS NUMBER

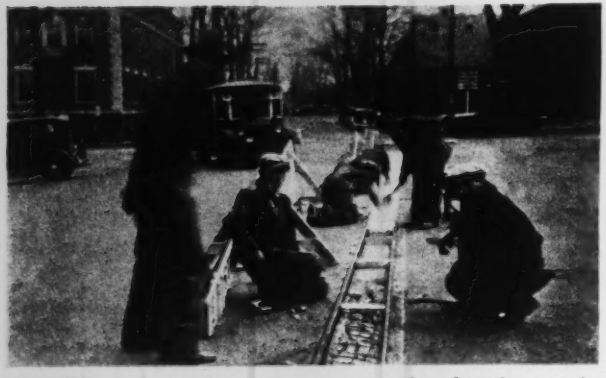
A total of $400,000,000 is being spent by the federal government in an unprecedented nationwide program of dam building — Grand Coulee, Bonneville, Parker, Fort Peck, Alcova, Seminoe, Norris and Joe Wheeler. Navigation, irrigation and flood control are involved. Many who look beyond the present spectacular construction operations see visions of power with no market, improved navigation with little river commerce, and increased irrigation side by side with too much producing land. What basis is there for such fears? Are these projects economically justified? Can they be made socially useful? How are they related to the comprehensive development of the rivers and regions that they serve? In the next issue a group of articles will set forth the significant facts that are needed in answering these questions. What in the way of economic justification and social usefulness lies behind the names and beyond the spectacular construction operations that they represent? This issue will attempt an answer.

WHITE CONCRETE TRAFFIC MARKERS ARE *EASY to BUILD*

1. In this asphalt-paved street in Middletown, Conn., for example, guide lines were marked on pavement and asphalt cut out in 12″ wide trench, down to concrete base.



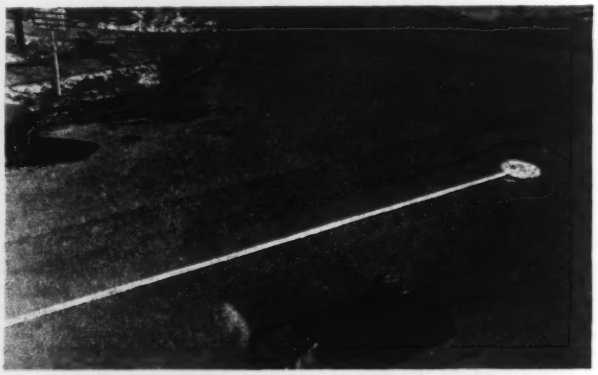
2. The next step was to undercut the edges of the trench, on both sides, to provide a mechanical bond between the asphalt and the marker. This was a simple job.



3. Then a layer of gray concrete was placed in the trench, and scratched to give a good bond. Before its initial set the one-inch topping of white concrete was placed.

4. Next the white concrete was troweled with a steel trowel to the smooth, hard, stain-resistant surface that will keep this white marker *permanently* white.

5. Finally the completed white concrete marker was covered with stainless paper and a layer of straw, to allow complete curing and to prevent freezing.



6. And here is the completed marker. It will guide traffic efficiently, for years, with *no replacement cost.* City Engineer Allen Schaefer built it with CWA labor. (Note—while CWA stops March 31, projects like this can be carried on under the Works Division of the Federal Emergency Relief Administration—FERA.) Write Universal Atlas Cement Co. (*Subsidiary of United States Steel Corporation*), 208 South La Salle Street, Chicago, for complete information.

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ATLAS WHITE TRAFFIC MARKERS

Made with Atlas White Portland Cement—Plain or Waterproofed

ENGINEERING NEWS-RECORD

November 22, 1934

Solid Steel Deck for a Railroad Bridge

Nine-span structure of Reading Company, built on new extensions of old piers, is first railroad bridge to use interlocking-channel type floor—Surfaced with asphalt plank, which carries conventional ballasted track

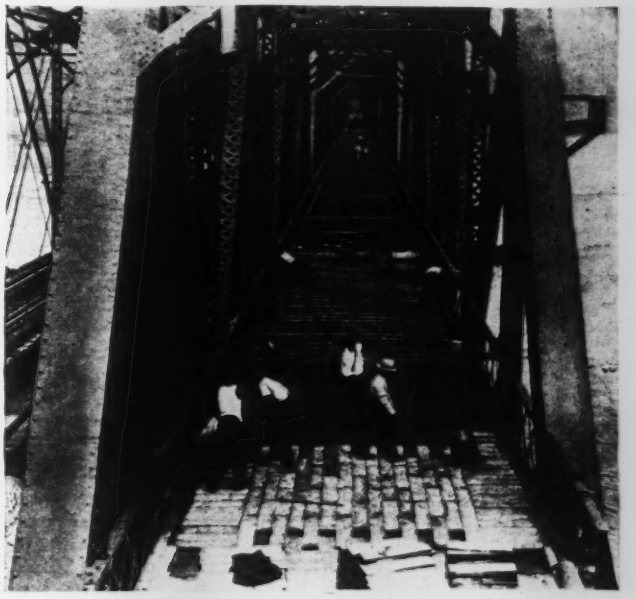


FIG. 1—APPLYING ASPHALT PLANK to the interlocking steel channel floor of the new Reading railroad bridge near Catawissa.

RECONSTRUCTION of the Susquehanna River (North Branch) crossing of the Reading Company between Rupert and Catawissa, Pa., occasioned the building of a new single-track, nine-span, riveted through-truss superstructure supported on concrete abutments and piers, built as extensions of the stone piers of the old bridge but self-supporting and carried to bearing on rock, while the old piers are founded on timber cribs. The most distinctive characteristic of the new bridge which was opened to traffic in October, is a welded, solid steel deck of interlocking-channel type covered with asphalt plank upon which the stone ballast is placed and allowed to take its natural side slopes. The installation marks the first use of this type of floor on a railroad bridge, although it has been used on about a dozen highway bridges. The center line of track on the new bridge is 29 ft. south of the center line of track on the old bridge, so that the new construction did not interfere with train movements.

In addition to the river crossing, changes were required in the approaches, principally on the north end where a seventeen-span concrete-arch viaduct about 800 ft. long adjoined the old steel truss spans erected in 1899. As stated, the new track comes off of the river bridge 29 ft. south of the center line of this approach viaduct. Some type of construction was required to connect the new alignment with the old, and an earthfill was chosen, since the openings provided by the old concrete arches were not required for flood discharge. Accordingly, a high fill on a long-radius curve was built, intersecting the old center line on the last span of the viaduct on the bank of the old Pennsylvania Canal. Part of the new fill buried the old viaduct, which was abandoned and left in place. The only change in the viaduct was an extension of the Pennsylvania Canal abutment (Fig. 2, right).

Foundations

As an aid in the work, particularly in coordinating the operations of the foundation and superstructure contractors, the railroad company built a temporary trestle and track on the new alignment, paralleling the concrete viaduct and giving access to the bridge site.

Foundation piers were constructed within three-sided timber cofferdams, the old pier comprising the fourth side. The water being shallow, a low trestle was built out from the shore, to give crawler cranes and other equipment access to the pier sites. Excavated material was disposed of in embankments back of the abutments. The downstream ends of the old piers and timber grillages were removed where necessary, to permit constructing a satisfactory joint between the new and old work, but otherwise the old piers were not disturbed. In forming the piers, the upstream edge was provided with a groove to permit extension of the piers for a double-track bridge if this should ever be needed. After the piers were finished and before the cofferdams were removed, the space between the cofferdams and the pier foundations was filled with two-man stone from the bottom of the foundation to the bed of the river.

In building the embankment for the north approach, it was required that it should be placed without disturbing the present arch rings of the approach viaduct and without interference with railroad traffic. The 33,000 cu.yd. of material required for the fill was obtained in near-by borrowpits and transported in trucks for the most part, although dump cars operating on the construction trestle were also used.

Superstructure

The new superstructure consists of nine steel riveted truss spans of about 157 ft. each, on a skew of 54 deg. It is designed for an E-70 loading, as compared with a loading comparable to E-48 on the old bridge. The trusses are 31 ft. deep, with parallel chords, and are set 18½ ft. apart c. to c., except for the first span on the south end which is 20 ft. 3 in. c. to c. center of trusses. One end of each truss is fixed, and the other end is on rockers.

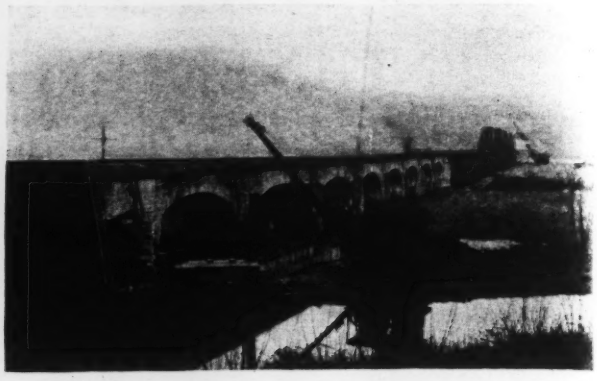


FIG. 2—FOUNDATIONS and approaches for the new structure involved extensive operations. Concrete viaduct (right) extending from old Pennsylvania Canal to river was buried in the new embankment. Shallow water in the river (left) permitted use of land equipment in extending the old piers.

In general, each truss is divided into seven 20-ft. and one 13-ft. panel. The floor system is continuous over the piers. The floor beams are made up of a 42x⅝-in. web, two 8x8x⅞-in. flange angles and two 20½-in. coverplates, full length on top and full length and 13 ft. long on the bottom for eight of the nine spans. In the 20-ft. panels two 36-in., 192-lb., wide-flanged beam stringers are used, one beneath each rail. In the end panels four 24-in., 100-lb., wide-flanged beam stringers are substituted, in order to provide for the expansion detail. These stringers are set on shelf angles riveted to the floor beams. At the ends of the fixed truss they are riveted to the shelf angle, while on the expansion truss they rest on a ¾-in. bearing plate free to slide on the shelf angles (Fig. 5).

Steel erection

Trusses were erected on falsework, using two locomotive cranes, one of 50-ton and one of 60-ton capacity. One crane unloaded and sorted material in the yard, feeding these materials to the erecting crane, and it also served as an auxiliary erecting crane. It was necessary to conduct all operations from the north end of the bridge because of foundation progress and the lack of rail connections on the south bank. Since eight of the nine spans were duplicates, one complete span was stored in the yard, to serve as a reserve supply in case of delays in transportation or hold-ups from other causes. The other spans were shipped from the fabricating plant in span units, the material being loaded in order of erection, to eliminate extra rehandling at the bridge site.

Erection proceeded by setting a bent of falsework, connecting it to the abutment or pier with the permanent floor system, laying the construction track and proceeding with the next bent of falsework until the span opening had been bridged. Sand jacks were provided on top of the falsework bents for slacking off the spans to make connections. The entire floor system together with the bottom chords but exclusive of the deck was placed before any of the truss members were erected. Then both cranes were brought into service to erect the truss steel, the forward crane always being in a position to swing completely around without interference from the truss members. The cars of material were spotted between the two cranes, so that various members of the trusses could be handled by either or both cranes. As soon as the steel was erected, the bottom-chord splices were riveted and the span swung free from falsework. The auxiliary crane filled in the remaining steelwork while the forward crane removed the falsework

FIG. 3—STEEL ERECTION was carried out by locomotive cranes. Floor framing for a span was placed complete before truss-member erection, shown above, was begun. The old bridge is at the right.

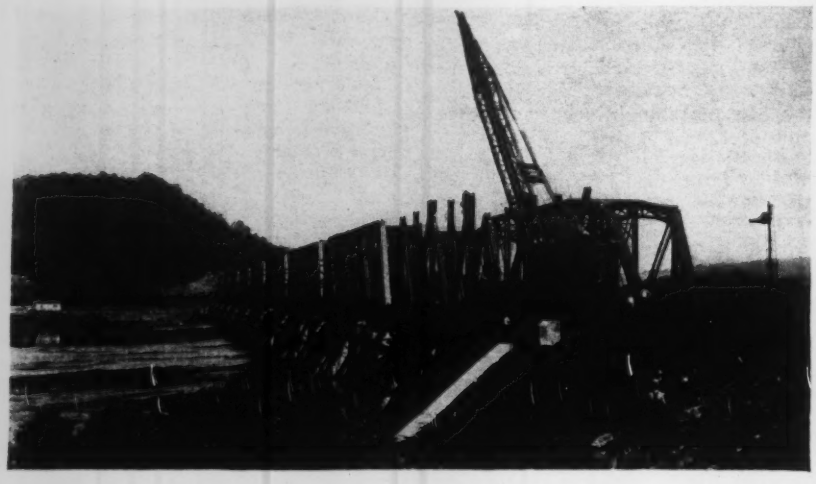
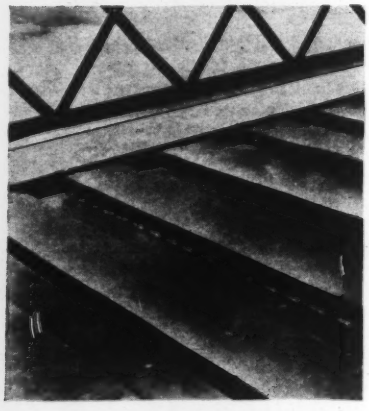


FIG. 4—FIELD WELDING consisted of plug welds, to fasten the deck to the stringers (top) and fillet welds to join the shop-fabricated section (bottom).



bents, transferred them to the span ahead and continued to lay the steel floor in the span.

Simple bents of falsework were used in preference to tower bents, as they could be thrown down and floated around in the shallow water to the span ahead. The use of sand jacks instead of wedges on top of the bents permitted swinging the spans clear of the falsework more rapidly.

In order to avoid interference and risk to the men during the operations, the general riveting was kept about two spans behind the erection. As soon as the truss spans were all completely connected and riveted, the steel deck floor was laid, starting from the far end with the crane backing away and taking up the construction track as it advanced.

Principal interest in the superstructure is in the floor deck, which is of the interlocking, steel-channel type, filled and surfaced with asphalt planks, waterproofed and ballasted. In comparison with a solid deck of conventional slab type, the steel floor is said to have effected a saving in dead load of 110 lb. per sq.ft., or about 1,600 lb. per linear-foot of bridge. The floor is made up of 10-in., 20-lb. channels arc-welded together with $\frac{3}{8}$-in. fillet welds $2\frac{1}{4}$ in. long, spaced 9 in. on centers, the channels being placed alternately up and down. On the field joints, between shop-fabricated floor sections, the top welds were made $4\frac{1}{2}$ in. on centers and the bottom welds were omitted. Shop-fabricated sections are the full width of the deck, about 15 ft. 4 in., and of such length that three sections occupy a 20-ft. panel length.

FIG. 5—FLOOR FRAMING and details of the interlocking steel channel deck, which was shop-fabricated into full-width 20-ft. panel-length units.

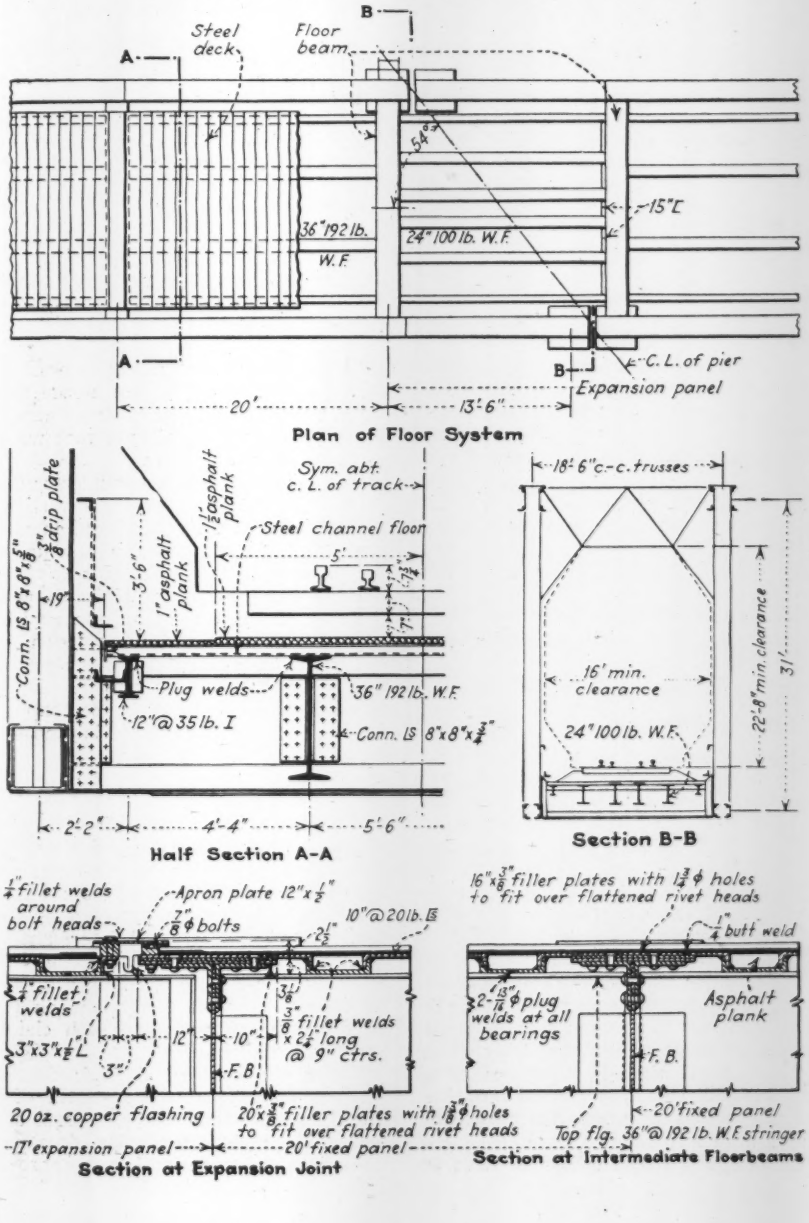


FIG. 6—STANDARD ballasted track construction is carried across the new bridge on the solid steel deck.

The floor is attached to the top flanges of the intermediate stringers at "down troughs" by two $\frac{13}{16}$-in.-diameter plug welds and to the top flange of the outside stringers by one $\frac{13}{16}$-in.-diameter plug weld. The end floor sections of each panel are welded to the top flange of the floor beams by $\frac{13}{16}$-in. plug welds about 12-in. centers. In the floor beams the top-flange rivets were flattened to a maximum height of $\frac{3}{8}$ in., and a top flange plate, punched to fit over the flattened rivet heads, was tack-welded to 46 rivet heads in each floor beam.

The floor, top flange plate of floor beams, exterior stringers and drainage troughs, sole and masonry plates at abutments, drip plates, apron plates and bolts at expansion joints are of copper-bearing steel, with a copper content between 0.18 and 0.32 per cent.

Asphalt plank floor

The asphalt filler planks used on the floor are about 8 in. wide and fit closely between the channel flanges. They are of such length as to fit tightly against each other and also against a drip plate at the ends of the troughs. They were installed in two thicknesses, the total thickness being such that the top surface was at least $\frac{1}{16}$ in. and not more than $\frac{1}{8}$ in. above the surface of the adjacent steel channel. If over $\frac{1}{8}$ in. above the surface, the edges of the filler planks were chamfered. Planks were set in hot asphalt mopped on the steel floor as the planks were being laid.

Over the top of the filler planks a membrane waterproofing was applied and turned up 1 in. against the drip plate at the sides of the floor and cemented to it.

On top of this waterproofing an asphalt-plank protection course was

placed, made up of planks 8 in. wide 3 ft. long and 1 to 1½ in. thick. The 1½-in. planks were used for a width of 10 ft. directly under the track. Planks of the protection course were also laid in hot asphalt mopped on the membrane waterproofing as the planks were being laid. The top surface of the protection course was given a liberal coat of hot asphalt, to fill all the joints. This surface was then sanded, and the track ballast and track were constructed.

The bridge was designed and erected under the supervision of Clark Dillenbeck, chief engineer, The Reading Co. The substructure was built by the James McGraw Corp., and the superstructu by the Phoenix Bridge Co.; J. Kinter was superintendent of erecti W. C. Bearce foreman, and William Ellis assistant engineer of erecti The interlocking channel floor w fabricated by the Belmont Iron Work of Philadelphia.

Advice for Contractors Entering Government Work

IV—Unforeseeable Causes of Delay

Three previous articles have told the contractor to check against error in bids, to learn the law and contract and to be his own surety against unforeseen conditions

By Howard L. Jones
Cherrydale, Va.

THE STANDARD government construction-contract form provides for the deduction of liquidated damages, at a rate to be agreed upon before signing, for each day of delay in completing the work. The contract names the following causes of delay for the period of which an extension of time may be granted: "Unforeseeable causes beyond the control and without the fault or negligence of the contractor, including, but not restricted to, acts of God, or the public enemy, acts of the government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather."

The clause "unforeseeable causes beyond the control and without the fault or negligence of the contractor" has been given a rather narrow interpretation. The contractor is held to be required to use keen foresight and sound business judgment. The following are a few of the causes of delay for which no extension of time could be granted: contractor's plant taxed beyond its capacity; a few more rainy days than usual; unusual economic conditions; replacing unsatisfactory work; the bank holiday; work more difficult than expected. It has been held that severe winter weather, heavy rains and snow, an ordinary flood or freshet "are all a part of the general hazard assumed by the contractor."

In one case it was held that while the storm or cloudburst was an unforeseeable cause, it occurred after the date when the contract should have been completed. In another case it was held that fiscal agents of the government are not required to deduct liquidated damages for the period intervening between the effective date of an order, issued in accordance with the terms of the contract, for the suspension of activities during the winter period and the effective date of the order to resume operations, when the contract period included the winter season.

If the contractor defaults in delivery under the standard form, the administrative officers have the option of permitting the contractor to continue performance or of canceling the contract. If the contract is not canceled, the question of whether the contractor is chargeable with liquidated damages is one for the consideration of the accounting officers or the courts. In such cases the administrative officers may not grant an extension of time but should report the facts of the delay to the Comptroller General for a legal determination as to whether liquidated damages should or should not be charged under the contract.

It has been held that any provision included in the specifications purporting to authorize the granting of an extension of time by the administrative officers is contrary to the terms of the provision approved by the President and cannot be recognized. In one case it was attempted to provide for a waiver on the certificate of the engineer that the delay had caused no actual damage to the United States. This clause was not recognized, as it purported to authorize a waiver of the vested rights of the United States.

Notice of delay

It is a provision of the standard construction contract that the contractor shall, within ten days of the beginning of any delay, notify the contracting officer in writing of the cause of delay. This provision has been strictly construed by the accounting officers and the courts. In the case of claims for an extension of the contract time for completion because of delays due to certain causes, it has been held to be unnecessary to determine whether the alleged causes of delay were causes excusable under the contract, for the reason that failure to submit a claim or report a delay within the required time is a waiver of all claims and right to an extension of time. A claim filed long after the alleged delays were incurred cannot be considered even if they would otherwise have entitled the contractor to an extension of time. The Supreme Court of the United States held in this matter as follows:

> "The contract required that such notice should be given * * * when the delay occurred, evidently for the purpose of informing the department and enabling it, at the time, to remove the cause of delay * * * for failure to comply with this requirement of the contract the plaintiff is not entitled to recover."

In the case of a failure on the part of the government to make the work available to the contractor for commencement, it was held that the matter was not one involving liquidated damages until the government makes it possible for the contractor to commence the work. It was said the contract period began to run from the date that work was ready for contractor.

In a case in which the contractor defaulted and the work was re-advertised (a new contract having been entered into prior to the completion date under the defaulted contract), it was held that as the contractor's right to proceed was terminated before the expiration of the date fixed for completion, no liquidated damages accrued, the standard contract providing only for liquidated damages in the event the contractor is permitted to continue beyond the date fixed for completion.

Delays by government

As a general rule such delays may be considered only as a basis for an extension of time. The courts have allowed recovery in certain cases where contractors have been damaged by delays due to unwarranted interferences with the work by the contracting officer, or where there has been a breach of express contract obligations on the part of the government. Such claims must be settled in court.

When the contract depends for its binding force upon the approval of a certain government officer, a legal and enforcible right thereunder does not come into existence until such approval

has been given. A delay in the approval of such a contract can impose no liability upon the government for damages in the form of reimbursement for increased costs of labor and materials because of the delay in approval.

In regard to the waiver of liquidated damages it was said in 49 Ct. Cls. 327:

"It is unquestionably true that an official of the government is not authorized to give away or remit a claim due the government. This rule is grounded in sound public policy and is not to be weakened."

Photo-Elasticity Apparatus Embodies Novel Features

By Elmer K. Timby

Assistant Professor of Structural Engineering, Princeton University

PHOTO-ELASTICITY as a means of solving stress problems has become increasingly popular in the last few years, due first, to the availability of a material from which to make inexpensive models, and, second, to the development of suitable optical equipment. Of the several materials used at present, a clear bakelite seems to be the most popular. It can be machined into shape readily, has a high unit strength and good elastic properties, possesses excellent optical characteristics and is relatively inexpensive. The increased use of the method has attracted the attention of the companies selling scientific equipment, and most of them now offer apparatus specifically designed for photo-elastic work. However, one piece of equipment that has been lacking is a suitable device for loading the models. Most investigators have met this problem by making small and crude pieces of apparatus for each particular problem. This of course takes considerable time and adds to the labor of making an analysis.

In equipping the photo-elastic laboratory at Princeton University, the writer designed a straining frame generally adapted to photo-elastic studies and made it a part of an assembly that supports the optical system, the whole being known as the universal photo-elastic testing machine.

All-purpose straining frame

The straining frame may be used for tension, compression, bending or shear, with a maximum total load of 1,000 lb. To change from tension to compression, or vice versa, requires but the changing of four small pins, each readily accessible. These four pins attach the horizontal bars, between which the model is loaded, to the vertical loading bars. Due to the nature of the weighing mechanism, the load applied to it must always be a downward force, just as is the case in most of the standard testing machines. If the model is to be loaded in compression, as indicated in the accompanying drawing, the lower horizontal bar receives the downward force and must therefore be connected to the weighing system (the inside pair of vertical loading bars) by the pins at its ends. On the other hand, if the model is to be loaded in tension, the upper horizontal bar receives the downward force, and it is therefore connected to the weighing system, and the lower one is connected to the outside pair of vertical loading bars, which exert the downward pull. Depending upon the nature of the loading, the machine is adjusted as for tension or compression when used to produce shear or bending. A slight pressure on the loading wheel applies the load gradually and uniformly through worm gears and threads. The weighing system employs flexible stainless-steel links as well as the more conventional knife edges. It is of the lever type and adequately sensitive over the full range.

The controls are designed for the maximum convenience of a single operator. From his position at the control end of the table the operator may cut off or on any of the lamps on the machine or in the room; he may increase, decrease or determine the load, and move the optical system so as to include in the field of view any portion of a model as large as 7x12 in. All of these adjustments are made by the operator while he is in a position to view the image as it is being formed on the screen of the camera. Those familiar with the technique of photo-elastic research will realize that this feature of centralized control is of the greatest importance; not only does it speed up the work but it eliminates the need for a second operator.

As has been stated, the machine is unique in that when studying a model larger than the field of view the entire optical system is traversed over the stationary model. The optical system may be moved either horizontally or vertically, or in both directions simultaneously. Horizontal motion is produced by turning the traversing wheel. This wheel is mounted on a shaft, which is supported from the optical bench and carries two small pinions. The pinions mesh with fixed gear racks set just below the horizontal pieces on which the bench slides.

To produce vertical motion, the operator turns the elevating wheel. The shaft on which this hand wheel is mounted turns four nuts, one on each elevating screw. Each nut is rotated exactly the same amount, and the horizontal supports for the optical bench are thus moved vertically, always being kept in a horizontal plane. The lower end of each elevating screw slides inside the hollow tube forming the table leg directly beneath it.

Another convenient feature of the machine is that the straining frame may be moved in a direction parallel to the axis of the optical system. This flexibility makes it much easier to obtain the desired size of image in sharp focus, and reduces the need of moving the optical parts to accomplish this purpose.

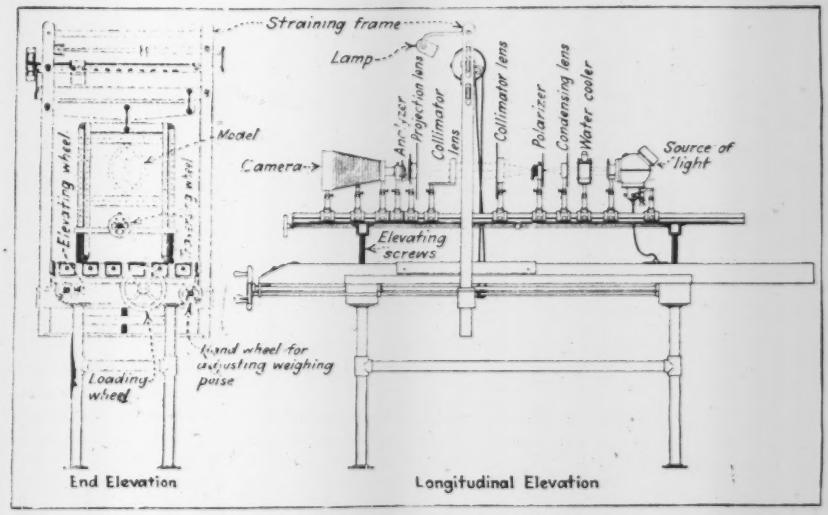


PHOTO-ELECTRIC MACHINE developed at Princeton includes a universal straining frame and centralized control of all operations necessary to make stress studies on transparent models of structure.

Boulder Dam Cement and Concrete Studies

From the mass of data accumulated in the three years of intensive cement and concrete investigations made by the Bureau of Reclamation, the basic information on characteristics and properties is outlined

By R. F. Blanks
Engineer, Bureau of Reclamation, Denver, Colo.

KNOWLEDGE of cement and concrete characteristics has been materially advanced by the extensive research made during the past three years by the Bureau of Reclamation in connection with the Boulder Dam project. Throughout the same three-year period the Portland Cement Association has carried on a monumental laboratory study of cement composition in relation to its effect on the properties of mortars and concretes; some 70 different cements were involved. These two important investigations are reported in his article and the one that immediately follows.

Many engineers will not feel the need of reviewing the mass of data that these studies produced, but everyone interested in the field of mass concrete, either from the standpoint of design or construction, should be informed on the fundamentals of this new information. The two articles herewith presented are planned to furnish this to them. —EDITOR.

THE INTENSIVE research program on cement and concrete that has been an important feature in the Boulder Dam project has resulted in voluminous data of value to engineers for a more fundamental understanding of mass-concrete construction. The complete report on this program will require nine printed government bulletins that are now in the process of preparation. However, it is possible, with the assembling of the data approaching completion, to summarize briefly some of the outstanding information of more general interest.

At the outset it is essential to recall that statements made and data presented apply only to Boulder Dam aggregate used under the particular conditions that governed these tests. It is believed that most of the findings are applicable to mass concrete in general, but time and future experience will be required to confirm or disprove this opinion.

Scope of data

Divided into its major phases, the investigation and the conclusions reached may be briefly stated as follows:

1. Information and supporting data were obtained for drafting a working specification for the purchase and acceptance of low-heat portland cement for Boulder Dam. (See *ENR*, Nov. 10, 1932, p. 558; also Specifications No. 556, U. S. Bureau of Reclamation, Portland Cement for Boulder Dam, March 26, 1932.)

2. The various properties of low-heat cement have been definitely established in direct comparison with corresponding properties of standard portland cement.

3. Various thermal properties of mass concrete, necessary in computations dealing with temperature changes and movements, have been determined, and the major factors controlling these properties are established. It has also been proved that laboratory determinations of thermal properties may be used for accurately predicting temperature changes and movements in mass concrete under field conditions.

4. The effect of size of test specimens on compressive strength and other properties of concrete have been evaluated for cylinders ranging from 2x4 in. to 36x72 in.

5. The relationship between maximum size of aggregate and various properties of concrete has been established for mixes in which the maximum aggregate varies from ¾ in. to 9 in.

6. The effect of wet-screening on the properties of concrete and the relationship between full-mix mass concrete tested in large specimens and wet-screened concrete tested in the usual 6x12-in. field-control cylinders have been established by tests with mixes ranging from 9-in. maximum aggregate mass concrete to ⅜-in. maximum wet-screened concrete.

7. The properties of concrete for conditions of mass curing have been determined in direct comparison with standard or continuous fog-curing conditions.

8. The development of basic concrete

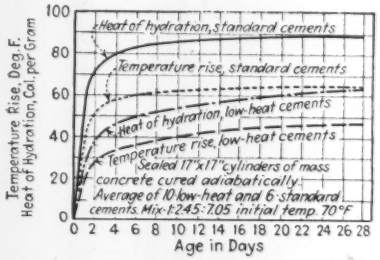

Heat of hydration, standard cements
Temperature rise, standard cements
Heat of hydration, low-heat cements
Temperature rise, low-heat cements
Sealed 17"x17" cylinders of mass concrete cured adiabatically:
Average of 10 low-heat and 6 standard cements. Mix-1:2.45:7.05 initial temp. 70°F
Temperature Rise, Deg. F.
Heat of Hydration, Cal. per Gram
Age in Days

FIG. 1—TEMPERATURE RISE and heat of hydration of low-heat and standard cements in mass concrete

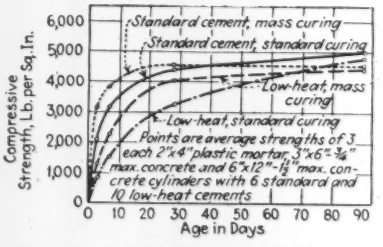

Standard cement, mass curing
Standard cement, standard curing
Low-heat, mass curing
Low-heat, standard curing
Points are average strengths of 3 each 2"x4" plastic mortar, 3"x6"-¾" max. concrete and 6"x12"-1½" max. concrete cylinders with 6 standard and 10 low-heat cements
Compressive Strength, Lb. per Sq. In.
Age in Days

FIG. 2 — COMPRESSIVE STRENGTHS (mortar and concrete) of low-heat and standard cements.

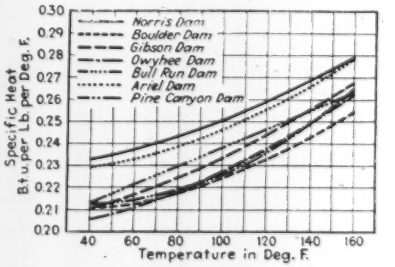


FIG. 3—SPECIFIC HEAT of concretes representative of several important dams.

COMPARISON OF PHYSICAL AND CHEMICAL PROPERTIES OF STANDARD AND LOW-HEAT PORTLAND CEMENTS

PHYSICAL

Type of Cement	Per Cent Passing 200 Mesh	Spec. Surface Sq. Cm. Per Gr.	Spec. Grav.	Initial Set, Hr.-Min.	Final Set, Hr.-Min.	Normal Consistency	W/C by Wgt.	Slump, Inches 1:2.9 Plast. Mortar	1:5.2 3" Max. Conc.	1:5.75 1½" Max. Conc.	1:9.5 6" Max. Conc.
Standard Av. of 6	93.9	1795	3.16	3-15	5-40	23.3	.54	1½	3	4¼	2½
Low-Heat Av. of 10	94.6	1950	3.16	2-35	5-05	22.6	.54	?	3	4¼	2¾

CHEMICAL COMPOSITION

Type of Cement	Chemical Analysis SiO_2	Al_2O_3	Fe_2O_3	Ca O	Mg O	SO_3	Ignition Loss	Compounds C_3S	C_2S	C_3A	C_4AF
Standard Av. of 6	21.8	6.2	2.9	63.8	2.6	1.7	1.1	40	32	12	8
Low-Heat Av. of 10	23.8	5.2	4.6	60.5	2.8	1.9	1.2	18	54	6	14

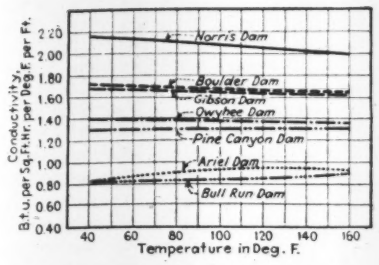


FIG. 4—THERMAL CONDUCTIVITY of concretes representative of several dams.

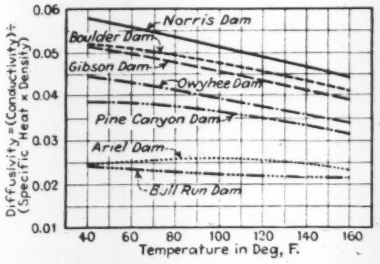


FIG. 5—THERMAL DIFFUSIVITY of concretes representing several dams.

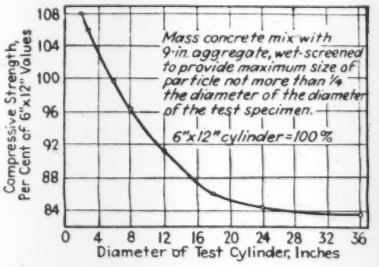

Compressive Strength, Per Cent of 6"x12" Values
Mass concrete mix with 9-in. aggregate, wet-screened to provide maximum size of particle not more than ¼ the diameter of the diameter of the test specimen.
6"x12" cylinder = 100%
Diameter of Test Cylinder, Inches

FIG. 6—TEST-CYLINDER size effect on compressive strength of the mass mix, wet-screened to provide maximum size of particle not more than one-fourth the specimen diameter.

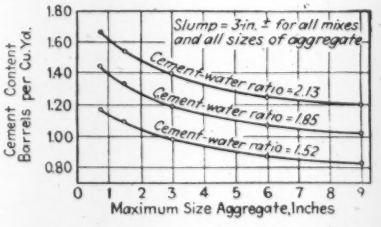

Cement Content, Barrels per Cu. Yd.
Slump = 3 in. ± for all mixes and all sizes of aggregate
Cement-water ratio = 2.13
Cement-water ratio = 1.85
Cement-water ratio = 1.52
Maximum Size Aggregate, Inches

FIG. 7—CEMENT REQUIREMENTS, with maximum size aggregate, for several water-cement ratios.

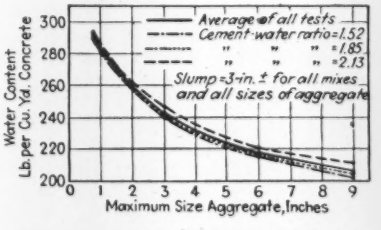

Water Content, Lb. per Cu. Yd. Concrete
Average of all tests
Cement-water ratio = 1.52
Cement-water ratio = 1.85
Cement-water ratio = 2.13
Slump = 3 in. ± for all mixes and all sizes of aggregate
Maximum Size Aggregate, Inches

FIG. 8—WATER REQUIREMENTS for mass mix with 3-in. slump.

mixes has been proved to be essentially a problem of design rather than construction and can be accomplished more effectively in a properly equipped centralized laboratory than in the field-control laboratory. Also, it has been found that remarkably close agreement can be obtained between laboratory and field results. (See *ENR*, Dec. 21, 1933, p. 737.)

Properties of low-heat cement

The physical properties of the low-heat cement for Boulder Dam are practically identical to the corresponding properties of high-heat (standard portland) cement, as shown in the accompanying table. The only difference of importance is that the low-heat cements are somewhat finer and therefore result in concrete of improved workability. However, a wide range is represented in the potential compound compositions of the two types. The low-heat cements are characterized by high percentages of di-calcium silicate (C_2S) and tetra-calcium alumino-ferrite (C_4AF), with relatively low percentages of tri-calcium silicate (C_3S) and tri-calcium aluminate (C_3A) as compared with relatively high C_3S and C_3A for standard cements.

Low-heat cements result in considerably lower temperature rise and less heat of hydration than the normal products (Fig. 1), yet it will be noted that the compressive strengths at 90 days are very nearly equal for both standard and mass curing (Fig. 2). Standard curing refers to continuous storage of unsealed specimens in fog rooms maintained at about 70 deg. F., and mass curing applies to specimens sealed in thin metal containers and stored in adiabatic calorimeter rooms on a rising temperature cycle for 28 days and at 70 deg. F. thereafter. It is interesting to compare the gradual but continuous strength development of the low-heat cements with the high-early strength attained by the standard cements.

Specific heat and conductivity

Values for specific-heat conductivity and diffusivity for mass concretes (water-saturated) representative of several dams are shown in Figs. 3, 4 and 5. It is apparent that the thermal properties vary between rather wide limits for the different conditions represented. The major factors accounting for the variations, in the order of their importance, have been determined as follows: (1) rock type of aggregates with respect to mineral composition; (2) water content of the concrete mix; and (3) temperature of the concrete. The variation in specific heat for different concretes as represented in Fig. 3 might account for 10 per cent or more difference in the temperature rise resulting from heat of hydration of the cement in a given structure and, hence,

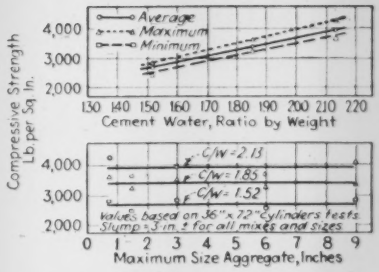


FIG. 9—COMPRESSIVE STRENGTH (average of 28- and 90-day test) of concrete compared with cement-water ratio and the maximum size of aggregate.

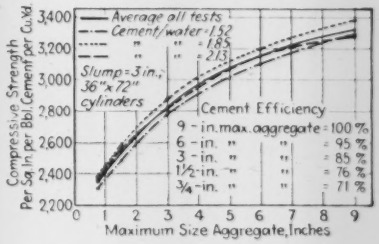

Compressive Strength Per Sq. In. per Bbl. Cement per Cu. Yd.
Average all tests
Cement/water = 1.52
" " = 1.85
" " = 2.13
Slump = 3 in., 36"x72" cylinders
Cement Efficiency
9-in. max. aggregate = 100%
6-in. " " = 95%
3-in. " " = 85%
1½-in. " " = 76%
¾-in. " " = 71%
Maximum Size Aggregate, Inches

FIG. 10—EFFICIENCY of cement in concrete compared with the size of aggregate.

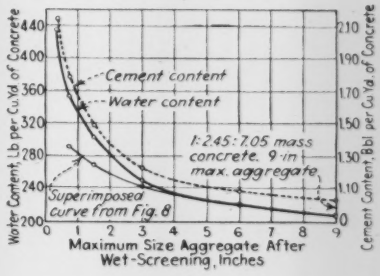

Water Content, Lb. per Cu. Yd. of Concrete
Cement Content, Bbl. per Cu. Yd. of Concrete
Cement content
Water content
1:2.45:7.05 mass concrete, 9-in. max. aggregate
Superimposed curve from Fig. 8
Maximum Size Aggregate After Wet-Screening, Inches

FIG. 11—WET-SCREENING EFFECT on the cement and water content of concrete.

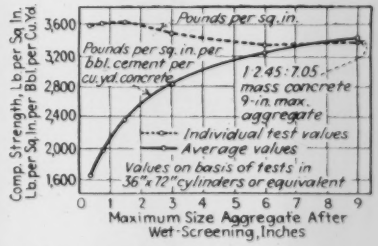

Comp. Strength, Lb. per Sq. In. Lb. per Sq. In. per Bbl. per Cu. Yd.
Pounds per sq. in.
Pounds per sq. in. per bbl. cement per cu. yd. concrete
1:2.45:7.05 mass concrete 9-in. max. aggregate
Individual test values
Average values
Values on basis of tests in 36"x72" cylinders or equivalent
Maximum Size Aggregate After Wet-Screening, Inches

FIG. 12—WET-SCREENING EFFECT on the compressive strength of concrete (average of 28- and 90-day tests).

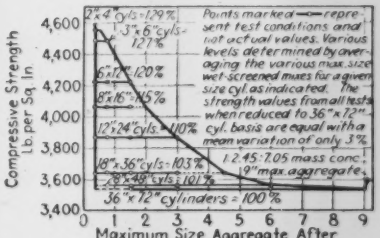

Compressive Strength, Lb. per Sq. In.
2"x4" cyls.-1.29%
3"x6" cyls.-1.27%
6"x12" 1.20%
8"x16"-1.15%
12"x24" cyls.-1.10%
18"x36" cyls.-1.03%
28"x48" cyls.-1.01%
36"x72" cylinders = 100%
Points marked — represent test conditions and not actual values. Various levels determined by averaging the various max. size wet-screened mixes for a given size cyl. as indicated. The strength values from all tests when reduced to 36"x72" cyl. basis are equal with a mean variation of only 3%
1:2.45:7.05 mass conc. 9" max. aggregate
Maximum Size Aggregate After Wet-Screening, Inches

FIG. 13—WET-SCREENING EFFECT on strength of concrete (average 28- and 90-day).

correspondingly greater or less volume change tending toward the formation of shrinkage cracks.

Similarly, the concrete having the highest values for thermal diffusivity, as shown in Fig. 5, would be cooled through a given temperature drop in one-half the time required for a concrete having the lowest diffusivity value represented. The thermal properties of mass concrete as determined in the laboratory, when used for computing the time-temperature histories of the various dams, produce values falling remarkably close to the curves plotted from actual field observations.

Aggregate and cylinder size

The comparative results of studies made on compressive strengths with identical concretes tested in cylinders of varying sizes are compared in Fig. 6, using the 6x12-in. size specimen as 100 per cent for a basis of comparison. Concretes containing maximum sizes of aggregate varying from ¾ in. to 9 in. were included in these tests. No consistent trends for the different concretes were detected, and apparently the average values represented by the curve apply within reasonable limits for any maximum size of aggregate concrete tested in cylinders having a diameter of not less than four times the largest particle.

The effect of varying maximum size of aggregate on the properties of concretes are shown in Figs. 7, 8, 9 and 10. Three different sets of mixes, having the cement-water ratios indicated, were used in this series of tests. It is of interest to note that, although a considerable spread for any given maximum size of aggregate exists in the cement required per cubic yard of concrete for the different cement-water ratios, the total water requirements per cubic yard for all three sets are practically equal. In other words, the water required for a given consistency (in this case, about 3-in. slump) and aggregate grading is substantially the same regardless of the richness of the mix.

Varying the maximum size of aggregate has no appreciable effect on the compressive strength of concretes of equal cement-water ratio and consistency when tested in the same size cylinder and for the conditions represented in Fig. 9. The values for the different maximum sizes occupy the same relative positions for all three sets of mixes; however, this appears to result from test conditions rather than the effect of the size of aggregate.

Cement efficiency

The cement efficiency (unit strength per unit of cement content) is substantially the same for any given size and grading of aggregate (Fig. 10), regardless of the richness of the mix, and decreases as the maximum size of aggregates is decreased. These data indicate the desirability of using 9-in. or larger cobbles in mass concrete. However, experience has shown that 9 in. is the largest size that can be economically and efficiently mixed and placed, and that even this limit may cause some trouble. Furthermore, there are indications that the larger the particle of aggregate, the more detrimental may be the weak laitance film formed on the underneath side of the particles in the compaction process. Investigations designed to throw additional light on this phase of the mass concrete problems are in progress.

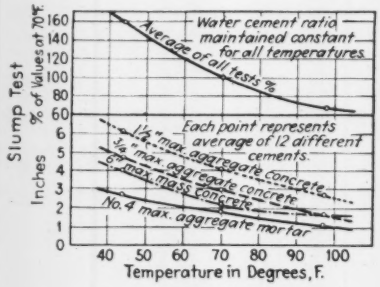

Slump Test
Inches
% of Values at 70°F.
Water cement ratio maintained constant for all temperatures
Average of all tests
Each point represents average of 12 different cements.
1½" max. aggregate concrete
3" max. aggregate concrete
6" max. mass concrete
No. 4 max. aggregate mortar
Temperature in Degrees, F.

FIG. 14—PLACING-TEMPERATURE effect on the consistency of the concrete at the mixer.

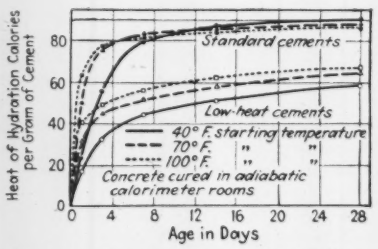

Heat of Hydration Calories per Gram of Cement
Standard cements
Low-heat cements
40° F. starting temperature
70° F. " "
100° F. " "
Concrete cured in adiabatic calorimeter rooms
Age in Days

FIG. 15—PLACING-TEMPERATURE and heat-of-hydration relation for low-heat and standard cement up to 28 days.

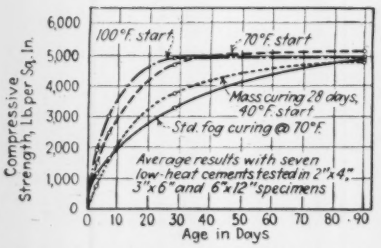

Compressive Strength, Lb per Sq. In.
100°F. start
70°F. start
Mass curing 28 days, 40°F. start
Std. fog curing @ 70°F.
Average results with seven low-heat cements tested in 2"x4", 3"x6" and 6"x12" specimens
Age in Days

FIG. 16—CURING CONDITIONS and compressive-strength relation for low-heat specimens in 2-, 3- and 6-in. cylinders.

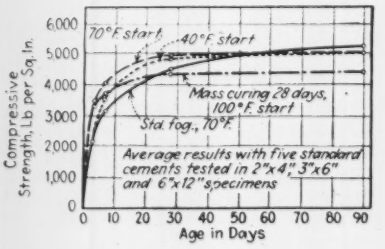

Compressive Strength, Lb per Sq. In.
70°F. start
40°F. start
Mass curing 28 days, 100°F. start
Std. fog., 70°F.
Average results with five standard cements tested in 2"x4", 3"x6" and 6"x12" specimens
Age in Days

FIG. 17—CURING CONDITIONS effect on compressive strength for standard cement in 2-, 3- and 6-in. cylinders.

The Bureau of Reclamation, accordingly, has adopted 6 in. as the maximum allowable size of aggregate for more recent work. The 5 per cent difference in cement efficiency between 6- and 9-in. maximum aggregate is more than compensated for in greater ease of control of mixing and placing and in improved uniformity of the finished concrete. Actually there would be no difference in efficiency with the Boulder Dam aggregates because that part of the cobbles between 6 and 9 in. can be replaced by equal amounts of 3- to 6-in. aggregate, without appreciable change in workability for the same water content.

Statements in the foregoing paragraphs are interesting when compared with a statement by F. R. McMillan in 1929, to the effect that about the same total amount of water is required in concrete to produce a given consistency regardless of the richness of the mix ("Basic Principles of Concrete Mixing," by F. R. McMillan, *ENR*, April 11, 1920, p. 582). Further, the curves in the upper half of Fig. 9 support Inge Lyse's contention that the cement-water ratio strength relationship for concrete is practically a straight line (*ENR*, Nov. 5, 1931, p. 723). Both of the above principles are inferred by Talbot and Richart in "The Strength of Concrete, Its Relation to the Cement, Aggregates and Water," University of Illinois Bulletin No. 137, p. 12.

Effect of wet screening

In the field-testing program for concrete control during construction it was obviously impossible to use the complete mix, including cobbles up to 9 in., for this would require 36-in.-diameter specimens on the basis of a cylinder four times the maximum size of aggregate. Therefore, it was essential to determine the relation between the compressive strengths and other characteristics of the complete mix, as tested in the 36x72-in. specimens and smaller sizes, using an identical mix, subsequently wet-screened to provide maximum aggregate not larger than one-fourth the diameter of the cylinder. This test series was made to establish the proper ratio between the properties resulting from wet-screened, as compared to those of the complete mix.

The summarized results of tests to determine the effect of wet-screening on various properties of concrete are shown in Figs. 11, 12 and 13. The similarity between the curves of Fig. 11 and Figs. 7 and 8 is apparent. The curves agree exactly for the larger sizes of aggregate but gradually diverge as the maximum size is decreased. When mass concrete is mixed with all sizes of materials in the mixer, no noticeable difference in slump is obtained when the resulting concrete is wet-screened to

varying sizes. However, when concrete is mixed to the equivalent of wet-screened concrete with successive sizes of coarse aggregate omitted, the slump increases from 3 in. for the mass-mix 9-in. maximum size, to 9 in. for the ¾-in. wet-screened mix. This effect has been termed the cobble effect and probably accounts for the disagreement between curves in Fig. 11 and Figs. 7 and 8 for the smaller sizes of aggregate.

Wet-screening does not materially affect the compressive strength of Boulder Dam mass concrete provided all tests are made in the same size of cylinder (Fig. 12). Accordingly, the strength relationship between wet-screened concrete tested in small cylinders, as used in field-control work, and full mass concrete tested in large cylinders is essentially the effect of the size of cylinder. This relationship is shown graphically in Fig. 13, using the average values from the curve in Fig. 6. The factors indicated have been found to hold for average results with natural aggregates, but the individual values seem to vary between rather wide limits. The indications from other tests show that there is considerably less difference when crushed aggregates are used.

It is possible that shape of particle, grading and elastic properties of the larger sizes of aggregate all have some bearing on the relative strengths obtained with wet-screened concrete tested in small cylinders and full-mass concrete tested in large cylinders. The relative values indicated in Fig. 12 are average results obtained with Boulder Dam aggregates.

Placing temperatures

The effect of placing temperature on the consistency of concrete, with the cement-water ratio maintained constant, is shown in Fig. 14. On the average, the gain in slump from 70 to 45 deg. F. placing temperature is about 55 per cent, but the loss at 95 deg. F., as compared with 70 deg. F., is only 35 per cent.

The effect of placing temperature on the heat generated by the hydration of cement in mass concrete cured under adiabatic conditions is presented in Fig. 15. The result is somewhat different for high-heat and low-heat cements at 28 days, although the difference might be reduced or even eliminated at later ages. The effect of mass curing for different starting temperatures on compressive strength is shown in Figs. 16 and 17 in direct comparison with standard fog-curing.

In conclusion, it may be stated that much needed information pertaining to the characteristics of mass concrete has been obtained, making possible a more scientific and efficient selection, combination and manipulation of materials for massive construction work. Space has prohibited giving any consideration in this article to other important subjects included in the Boulder Dam studies such as permeability, durability, elastic and plastic properties, volume change, contraction-joint grouting and many others. These will all be treated in detail in the proposed series of government bulletins.

Organization — Research work on mass concrete has been carried out in the Denver laboratories under the general supervision of B. W. Steele, designing engineer on dams, and under the direction of Arthur Ruettgers and the writer. All research and design work is under the direction of J. L. Savage, chief designing engineer. All engineering and construction is under the general direction of R. F. Walter, chief engineer, with headquarters in Denver. All activities of the bureau are supervised by Elwood Mead, Commissioner of Reclamation, Washington, D. C.

Effect of Cement Composition on Mortars and Concretes

Properties of mixtures made from cements of 72 different compound compositions reported for 1-, 2- and 3-year periods

By H. F. Gonnerman

Manager, Research Laboratory, Portland Cement Association, Chicago, Ill.

AT THIS YEAR'S ANNUAL MEETING of the American Society for Testing Materials, Mr. Gonnerman's paper entitled "Study of Cement Composition in Relation to Strength, Length Changes, Resistance to Sulphate Water and to Freezing and Thawing of Mortars and Concrete" was outstanding on the program. Current trends toward special cements are forcing the user to acquire a knowledge of cement chemistry that was not at all necessary when a single-standard product was all that was available. One advantage of Mr. Gonnerman's paper was that it evaluated the chemical compounds in terms of their effect on properties of concrete with which the user is directly concerned. A number of figures and tables accompany the text of the paper. The following abstract presents the essential conclusions and some of the more important data. —EDITOR.

THE comprehensive study of cement composition in relation to its effect on strength, length changes, resistance to sulphate waters and to freezing and thawing of mortars and concretes, inaugurated in 1930, has progressed to a point where significant results have been obtained. The keen interest in the nature of the compounds existing in cement, in the influence that these compounds have on the properties of the cement and in the development of specifications for special portland cements makes the presentation of the data particularly timely.

The tests reported here were made at the research laboratory of the Portland Cement Association in Chicago, using 74 laboratory-prepared portland cements, covering 72 different compositions prepared by the Portland Cement Association Fellowship at the Bureau of Standards. The investigation is being continued.

Cement manufacture

The raw materials for the cements studied consisted essentially of limestone and clay, although in a number of cases flint, bauxite, iron ore or dolomite were introduced in order to bring the mixtures to the desired compositions. The oxide compositions of the different cement clinkers and compound compositions were computed according to the method outlined by R. H. Bogue of the P.C.A. Fellowship at the Bureau of Standards, as published in *Industrial and Engineering Chemistry*, Oct. 15, 1929. The following abbreviations are used for the several compounds:

Tricalcium silicate	C_3S
Beta dicalcium silicate	C_2S
Tricalcium aluminate	C_3A
Tetracalcium alumino ferrite	C_4AF
Dicalcium ferrite	C_2F

Cement composition and strength

Reference to the strength results in Figs. 1, 2, and 3 reveals that the tensile and compressive strengths of mortar and concrete at various ages of tests are markedly influenced by the compound composition of the cement. This is to be expected when it is considered that each compound has its own characteristic strength properties and rate of gain in strength with age.

Influence of C_3S and C_2S—The chief strength-giving constituents of portland cement are the two silicates C_3S and C_2S. In the cements tested, the computed C_3S content ranged from 16 to 74 per cent by weight, and the C_2S content from 1 to 58 per cent. The sum of the two silicates ranged from 63 to 84 per cent. The present tests support the findings of others in that they indicate the predominating influence of the C_3S

on the strength up to 28 days and of the C_3S on the strength beyond the 28-day period. Other conditions being the same, cements high in C_3S (and correspondingly low in C_2S) produced the highest strength at early ages. However their *rate of gain* in strength tends to diminish with age, so that eventually they may be surpassed in strength by cement low in C_3S (high in C_2S) (Fig. 1).

These results are based on tests from specimens exposed continuously to moisture. In considering their practical application, it is important to note that even under these favorable curing conditions, the cements low in C_3S gained strength slowly. Had the specimens made with such cements been given only short periods of moist curing and then exposed to a dry atmosphere, it is probable that they would have shown considerable lower strengths than those found, particularly at the later ages.

In briquet tests, practically all of the cements showed the typical retrogression in strength at the later ages that is characteristic of this type of specimen when stored in water. But few of the cements showed any tendency toward retrogression in the compression tests of moist-cured specimens; where such a tendency occurred, the cements generally contained relatively high amounts of C_3A or of C_3A plus C_4AF.

Influence of C_3A and C_4AF — In a study of the effect on strength of increasing the C_3A content three groups of cements were selected, in each of which the C_3A content varied, but the C_3S, C_2S and C_4AF compounds were essentially constant, and the C_4AF varied from group to group (Fig. 2). At ages up to 28 days both the compressive and tensile strengths increased with increase in the C_3A content, but at later ages there was in general a tendency toward lower strengths for the higher C_3A content, other conditions being the same.

Results of tests on three groups of cements, each containing approximately constant amounts of C_3S, C_2S and C_3A but variable amounts of C_4AF, indicate that the C_4AF compound produced little if any change in strength.

Influence of Individual Compounds— Mathematical studies of the general relationships between composition and strength were made in order to derive equations that would give reasonably good agreement between calculated and observed values. It was found that linear equations of the form

$$a\,C_3S + b\,C_2S + c\,C_3A + d\,C_4AF = \text{strength}$$

served the purpose. The coefficients in these equations and their probable errors were computed by the method of least squares.

The values of the coefficients for the mortar specimens at each age of test are plotted in Fig. 3. The coefficients shown in Fig. 3 indicate the progressive effect of each compound with time up to two years, for each type of specimen for the particular condition of these tests. For all types of specimens the C_3S is continuously effective in increasing strength. The C_2S contributes little strength up to about 28 days but is largely responsible for the increases in strength beyond that period.

After the 7- and 28-day periods for the cubes and at all ages up to 28 days for the briquets, the C_3A appears to exert a greater effect on the strength than any of the other constituents. Its effect on strength diminishes beyond the 28-day period, and at one and two years it is either nearly zero or negative. In the case of the concrete cylinders the decrease in the effectiveness of the C_3A after the 28-day period was found to be less rapid.

The C_4AF had a negative effect on the compressive strength of the 1:2.75 cubes up to about 7 days, and in the case of the 1:4.25 cubes its effect was slight at all ages. In the case of the briquets the C_4AF appears to add to the strength after one day, although its effect diminishes beyond the three-month period.

CONCLUSIONS

From the results so far obtained, the following conclusions are indicated:

1. *Strength:*

***(a)* The principal strength-giving constituents of portland cement are the tricalcium and dicalcium silicates. Tricalcium silicate (C_3S) not only contributed much of the strength at the early ages but continued to be effective in increasing strength at the later ages also. Dicalcium silicate (C_2S) contributed little to strength up to about 28 days but was largely responsible for the increase beyond that period.**

***(b)* Tricalcium aluminate (C_3A) contributed to strength to an important degree up to 28 days, but its effect then diminished and became zero or negative at one and two years.**

***(c)* The role of tetracalcium alumino ferrite (C_4AF) is not so clearly indicated. It contributed to some extent to tensile strength after one day and to compressive strength of plastic mortars of 1:2.75 mix and of concrete at the 28-day and later periods.**

2. *Contraction in Air:*

C_3S and C_2S contributed, in approximately the same degree, to the total contraction but to a much lesser degree than C_3A, and to a somewhat greater degree than C_4AF.

3. *Resistance to Sulphate Solutions:*

***(a)* Of the four major compounds, C_3A appeared to be the only one that reduced the resistance of mortar and concrete to 2 per cent solutions of magnesium and sodium sulphate. However, specimens exposed for a period of three years showed good resistance to the magnesium sulphate solution when the C_3A content of the cement did not exceed 6 or 7 per cent, and to the sodium sulphate solution when it did not exceed 6 to 10 per cent.**

***(b)* In general, there was a noticeable decrease in the expansion of cylinders stored in the sulphate solutions with decrease in the C_3A content of the cement. Where the C_3A content was 7 per cent or less, the expansions during the two years covered by the observations were not excessive. The expansion in water also tended to decrease with decrease in C_3A.**

4. *Resistance to Freezing and Thawing:*

On the basis of the expansions and losses in weight exhibited by concrete cylinders subjected to an accelerated freezing and thawing test, the higher the total of C_3S and C_2S in the cement, the greater the resistance of the concrete. On the other hand, the greater the C_3A and C_4AF, the lower the resistance. The effect of C_3A in lowering the resistance was indicated to be considerably greater than that of the C_4AF.

The high values of the C_3A factors at 28 days are not easily explained. Bogue and Lerch (P.C.A. Fellowship), consider the effect to be due to a secondary cause rather than to a direct contribution to strength of the order indicated. They suggest that since C_3A requires a larger amount of water for hydration than the other cement compounds, increasing its percentage in a series of tests such as this, where a nearly uniform quantity of water is used for mixing, will increase the amount of water that will be taken up by the C_3A, leaving decreasing amounts for the silicates. The resulting decreased water-silicates ratio may then result in the proved strength commonly associated with decreased water-cement ratios. Bogue and Lerch further suggest that the negative values of the factors for C_4AF may be due to a deposition of colloidal hydrated $CaO.Fe_2O$ around the grains of the other compounds, thus delaying their rate of reaction with water.

Cement composition and length changes

For studying the influence of cement composition on length changes, 3x3x15-in. mortar bars of 1:3.6 mix by weight were utilized. Expansion and contraction were found to be virtually independent of the relative proportions of C_3S, C_2S and C_4AF, but variations in the proportion of C_3A had an appreciable influence. In general, as the C_3A content increased there was a tendency toward increased expansion of the bars during

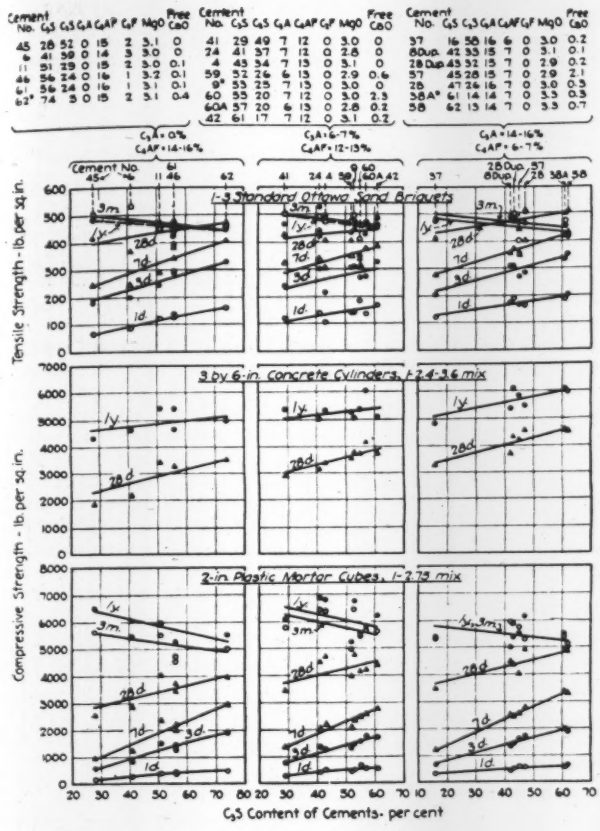

Tensile Strength - lb. per sq. in.
1-3 Standard Ottawa Sand Briquets
3 by 6-in. Concrete Cylinders, 1-2.4-3.6 mix
Compressive Strength - lb. per sq. in.
2-in. Plastic Mortar Cubes, 1-2.75 mix
C3S Content of Cements - per cent

FIG. 1—TRICALCIUM SILICATE (C_3S) content of cement not only contributes much of the early strength but continues to be effective, along with the C_2S, at the later ages.

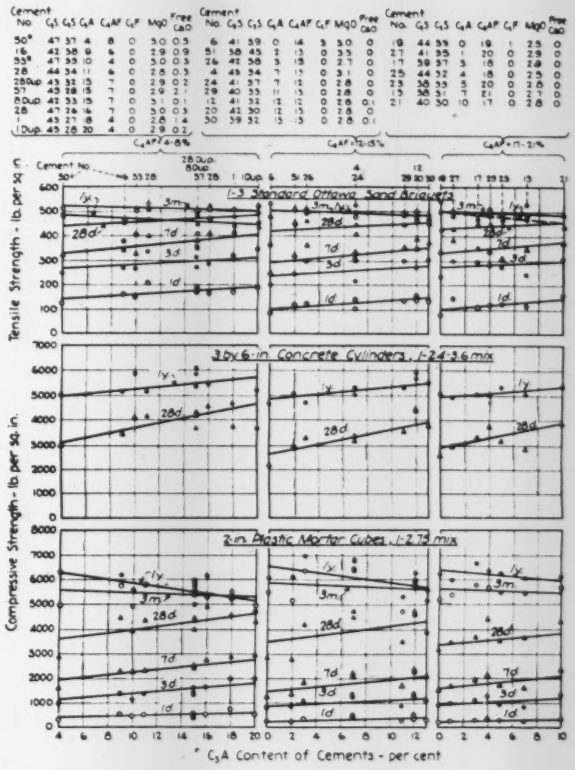

Tensile Strength - lb. per sq. in.
1-3 Standard Ottawa Sand Briquets
3 by 6-in. Concrete Cylinders, 1-2.4-3.6 mix
Compressive Strength - lb. per sq. in.
2-in. Plastic Mortar Cubes, 1-2.75 mix
C3A Content of Cements - per cent

FIG. 2—TRICALCIUM ALUMINATE (C_3A) content of cement affects strength of mortars and concretes most during the first 28 days, after which its influence diminishes.

a three-month storage in the moist room, and increased total contraction after fourteen months' and two years' storage, for bars allowed to dry in the air of the laboratory at about 50 per cent relative humidity. The tests include both seven days' and three-months' storage in a moist room before drying (Fig. 4).

For the bars moist-cured for seven days, the values of total contraction at fourteen months ranged from 0.07 per cent for a C_3A content of zero per cent to about 0.11 per cent for a C_3A content of 20 per cent. Approximately the same range in total contraction was obtained at an age of two years for the bars that were moist-cured for three months before they were allowed to become dried out in the air of the laboratory.

Composition and Total Contraction—Coefficients of linear equations representing the relation between composition and total contraction of the mortar bars were derived by the method of least squares, using those cements that contained less than 1 per cent free lime and approximately 3 per cent MgO.

An analysis in the laboratory of 57 cements showed the following coefficients and probable errors for the different compounds:

CO-EFFICIENTS OF LINEAR EQUATIONS

Compound	After 7 days' moist curing. Total age 12 months	After 3 months' moist curing. Total age 15 months
C_3S	0.00079 ± 0.000036	0.00082 ± 0.000036
C_2S	0.00077 ± 0.000033	0.00077 ± 0.000035
C_3A	0.00234 ± 0.000100	0.00213 ± 0.000105
C_4AF	0.00049 ± 0.000114	0.00046 ± 0.000118

The two silicates appear to have influenced total contraction to approximately the same degree but to a much less degree than the C_3A, and to a somewhat greater degree than the C_4AF. Other investigators have also reported that the C_3A compound has the greatest influence on the total contraction of mortar bars.

Cement composition and resistance to sulphate solutions

Concrete cylinders, 2-in. plastic mortar cubes and standard briquets made with each cement were, after 28 days of moist curing, stored in large tanks containing 2 per cent solutions of magnesium and sodium sulphate. The solutions were kept essentially constant by periodic adjustments of their sulphate content.

The ratings of the various specimens after exposure to the solutions were determined by visual inspection. Durability factors at 1-, 2- and 3-year periods were then devised, to facilitate the study and plotting of the results. These factors at a given yearly period are the sums of the separate ratings of all preceding six-month periods. For example, one specimen might have a rating of 9.0 and 8.0 at six months and one year respectively. The sum of these two ratings, 17.0, is the durability factor at the one-year period. Then if the ratings at 1½ and 2 years are 6.6 and 2.6, adding these ratings to those of six months and one year gives the durability factor at 2 years, 26.2. Durability factors for specimens in apparently sound condition at the end of one year are 20, at two years 40, and at three years 60 (a rating of ten for each six-month period). These values are the maximum attainable, and values between them and zero represent intermediate degrees of resistance at the particular period considered.

Detrimental Effect of C_3A—The data on the resistance of the cements to the sulphate solutions as influenced by each of the four major compounds were studied in the same manner as that employed in studying strength and length changes. No significant trends were observed for any of the compounds except C_3A. These studies as well as analyses of the durability factors showed that the C_3A had a marked

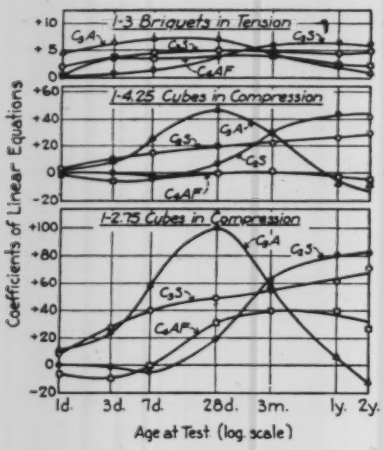

1:3 Briquets in Tension
1:4.25 Cubes in Compression
1:2.75 Cubes in Compression
Coefficients of Linear Equations
Age at Test (log. scale)
1d. 3d. 7d. 28d. 3m. 1y. 2y.

FIG. 3—COEFFICIENTS of linear equations representing relation between composition and strength (lb. per sq.in.). Coefficients calculated by method of least squares from values obtained in tests of 57 cements with constant MgO (2.5 to 3.4 per cent) and less than 1 per cent free CaO. Application of coefficients to other cements by extrapolation is subject to usual errors of such approximations.

detrimental influence on the sulphate resistance of the cement. It is of particular interest to note that lean 1:4.25 cubes made with cement low in C_3A showed much better performance than the richer 1:2.75 cubes made with cements high in C_3A. This confirms the findings of Bogue and Lerch that certain changes in composition have a greater effect upon resistance to sulphate attack than changes in richness of mix and water-cement ratio.

From diagrams showing durability factors plotted against C_3A contents, similar to those in Fig. 5, the maximum C_3A contents for good resistance to the solutions were determined for each type of specimen. The values are shown in the accompanying table.

It is seen from the above values for the three-year period that good resistance to the magnesium sulphate solution was obtained with all types of specimens when the C_3A content did not exceed 6 or 7 per cent, and in the case of the sodium sulphate solution when it did not exceed 6 to 10 per cent.

Strength in Sulphate Solutions—The strengths of specimens stored in the sulphate solutions were expressed as a percentage of the strength of similar specimens stored in water and tested at the same age. Typical data are plotted in Fig. 5. From diagrams such as these the approximate C_3A contents for strength ratios of 100 per cent were determined. The values obtained in this manner were, at corresponding ages, in fair agreement with the maximum C_3A contents for good sulphate resistance, discussed in the preceding section, which were derived from the durability factors.

Expansion in Sulphate Solutions — The linear expansions of 3x6-in. concrete cylinders made from 38 of the cements were measured at various periods

MAXIMUM C_3A CONTENTS FOR RESISTANCE TO SULPHATE SOLUTIONS

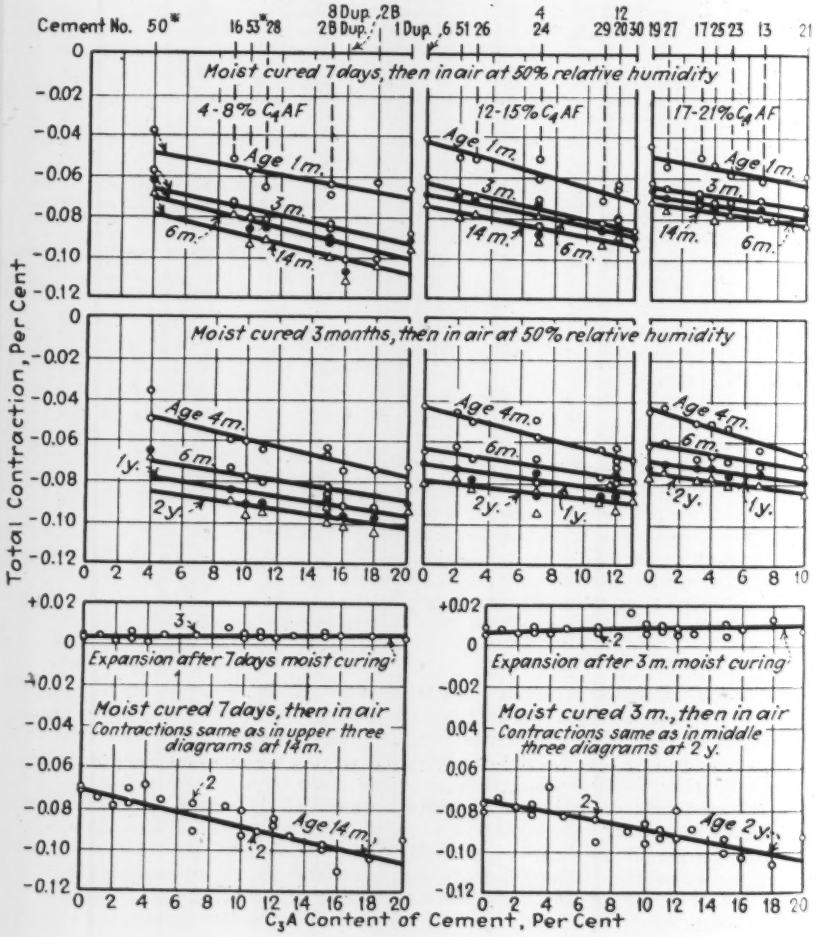
Type of Specimen	Water-Cement Ratio by Wgt.	Maximum C_3A Content for Good Sulphate Resistance at Period Indicated					
		2% $MgSO_4$ Solution			2% Na_2SO_4 Solution		
		1 yr.	2 yr.	3 yr.	1 yr.	2 yr.	3 yr.
3 x 6-in. conc. cyl	0.563	10	8	7	12	11	10
1:2.75 mortar cubes	0.533	8	7	6	9	8	6
1:4.25 mortar cubes	0.800	8	8	7	8	7	6
1:3 briquets	0.400	9	8	6	12	10	9

of storage in 2 per cent solutions of sodium and magnesium sulphate and in water after 1 day in the mold and 27 days in the moist room. The expansions of the cylinders in the solutions conformed closely to those of the cylinders in water until the action of the sulphate caused a sharp increase in the rate of expansion that marks the beginning of visual disintegration. In general, as the expansion increases, the extent of disintegration also increases. Where the C_3A content is 7 per cent or less, the expansions up to the two-year period were not excessive except in the case of a cement that contained 2.3 per cent uncombined lime. Expansions in water also tended to decrease with C_3A content.

Freezing and thawing

Specimens used for freezing and thawing tests consisted of three 3x6-in. concrete cylinders for each of 66 of the cements. These cylinders had been moist-cured 28 days and then stored in the air of the laboratory at approximately 50 per cent relative humidity for periods of 12 to 27 months. A special procedure was employed, involving twelve cycles of freezing and thawing, a 72-hour drying and 72-hour saturation period plus the time for cooling and measuring, requiring in all two weeks. Typical curves illustrating the expansion and loss in weight resulting from the indicated number of cycles of freezing and thawing are shown in the upper two diagrams of Fig. 6. The expansions and losses in weight shown are those determined at the time the specimens were removed from the thawing tank on the morning following each twelfth cycle, before introduction into the oven for the 72-hr. drying period. Figures re-

FIG. 4—LENGTH CHANGES in mortar bars become progressively greater as C_3A content of cement is increased. Compare with Fig. 2.


Cement No.
Moist cured 7 days, then in air at 50% relative humidity
4-8% C4AF
12-15% C4AF
17-21% C4AF
Moist cured 3 months, then in air at 50% relative humidity
Total Contraction, Per Cent
Expansion after 7 days moist curing
Moist cured 7 days, then in air
Contractions same as in upper three diagrams at 14 m.
Expansion after 3 m. moist curing
Moist cured 3 m., then in air
Contractions same as in middle three diagrams at 2 y.
C3A Content of Cement, Per Cent

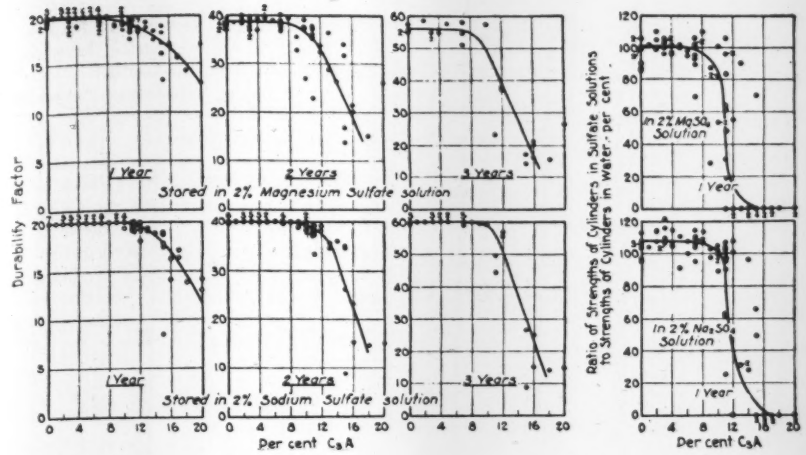

Durability Factor
1 Year
2 Years
3 Years
Stored in 2% Magnesium Sulfate solution
Stored in 2% Sodium Sulfate solution
Per cent C3A
Ratio of Strengths of Cylinders in Sulfate Solutions to Strengths of Cylinders in Water - per cent
In 2% MgSO4 Solution
In 2% Na2SO4 Solution

FIG. 5—CONCRETE exposed to sulphate solutions becomes less resistant as C_3A content of cement is increased. Specimens tested were 3x6-in. cylinders made with a w/c ratio of 0.85. Numerals at plotted points indicate number of identical values.

corded refer only to the number of freezings and thawings. For each twelve cycles recorded on the drawing there was an accompanying cycle of drying and saturation.

Of 66 cements tested, 42 showed loss-in-weight curves similar to the type A curve, while for the remaining 24 cements the loss-in-weight curves were similar to the type B curve in Fig. 6. The type A curve occurred most frequently in cements relatively low in C_3A, and the type B curve in cements relatively high in C_3A. Occasionally, however, this was reversed.

Effect of Cement Composition — Numerous studies were made of individual groups of cements, to see if there was any variation in their resistance to alternate freezing and thawing due to variation in composition. These studies indicated a trend toward increased resistance with increase in the C_3S and C_2S compounds, and a trend toward decreased resistance with increase in the C_3A and C_4AF compounds, the latter compound having considerably less effect than C_3A.

In the two lower diagrams of Fig. 6, the number of cycles which produced an expansion of 0.4 per cent and a loss in weight of 20 per cent is plotted against the C_3A content of the cement. The numbers in the diagrams identify the various cements, and the different symbols serve to indicate their approximate total silicate content. Definite trends toward increased resistance are indicated as the C_3A content is reduced.

It is probable that several factors such as the presence of chert particles in the coarse aggregate, differences in the degree of hydration and in age at time of test, and the limited number of specimens of each kind contributed to some extent in producing the spread indicated in the diagrams.

In a group of twelve cements the composition was varied in two ways by varying the MgO content. In six of the cements MgO was substituted for CaO in the raw mix, causing the C_3S to decrease from 49 to 11 per cent and the C_2S content to increase from 29 to 58 per cent, while the C_3A and C_4AF remained substantially constant at 11 and 10 per cent respectively. The MgO content of these six cements varied from 1.2 to 9.7 per cent.

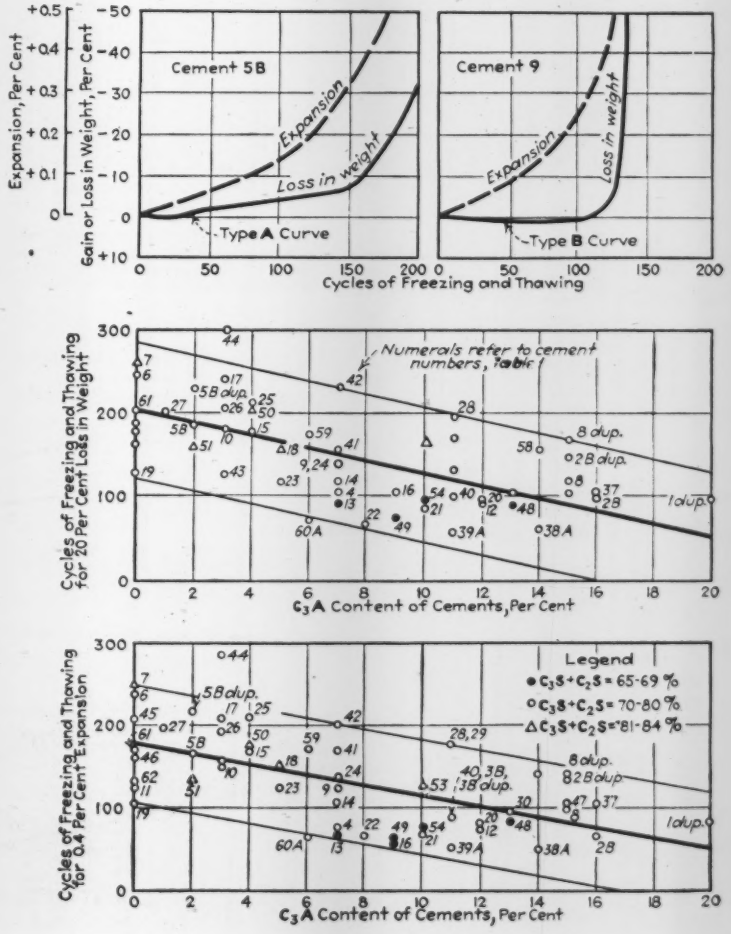
In the other six cements investigated, the MgO was used as an addition to the raw mix. When it was introduced, adjustments were made in the CaO and SiO_2 to maintain the C_2S approximately constant at 45 per cent. The C_2S decreased from 36 to 23 per cent, and the C_3A and C_4AF remained constant at 11 and 9 per cent respectively. The MgO in these cements varied from 1.4 to 9.9 per cent.

Results with MgO cements

Substitution of MgO for CaO in the raw mix produced cement which showed at all ages a gradual decrease in strength, with an increase in MgO content, apparently due to a change in the relative proportions of C_3S and C_2S. The addition of MgO in the raw mix produced little effect on the strength of either mortar or concrete except for an MgO content of 7 per cent or more where decreased strength occurred at the one and two-year periods.

Concrete cylinders stored in water for

FIG. 6—RESISTANCES of cements of different composition to freezing and thawing, as revealed by studies on 3x6-in cylinders. Expansion and loss in weight are shown at top. The lower diagrams indicate a tendency toward increased reistance as C_3A content is reduced.


Expansion, Per Cent
Gain or Loss in Weight, Per Cent
Cement 5B
Cement 9
Expansion
Loss in weight
Type A Curve
Type B Curve
Cycles of Freezing and Thawing
Cycles of Freezing and Thawing for 20 Per Cent Loss in Weight
Cycles of Freezing and Thawing for 0.4 Per Cent Expansion
Numerals refer to cement numbers, table 1
C3A Content of Cements, Per Cent
Legend
C3S+C2S = 65-69 %
C3S+C2S = 70-80 %
C3S+C2S = 81-84 %

20 months showed increased expansion, with increase in the MgO content of the cement regardless of whether MgO was added to the raw mix or substituted for CaO.

Excessive expansion in sulphate solutions was recorded where the MgO content was greater than 5 or 6 per cent in the case of magnesium sulphate and when greater than 7 per cent in the case of sodium sulphate. Concrete subjected to alternate freezing and thawing showed a tendency toward increased expansion and greater loss in weight as the MgO content of the cement increased.

Typhoon Damage in Japan Caused by Record High Tide

Disaster of Sept. 21 accompanied by barometer pressures as low as 27 in. of mercury, by wind velocities of 100 m.p.h. and gust velocities as high as 134 m.p.h.

By Haruo Matsuo
Research Office of Public Works, Department of Home Affairs, Tokyo, Japan

THE TYPHOON which swept the western part of Japan on the morning of Sept. 21 caused severe damage to the industrial centers of Japan. The total loss is estimated at 500,000,000 yen or more. According to the police bureau, 2,593 lives were lost in the disaster, and in Osaka alone some 110,000 houses were inundated. The typhoon, the extraordinary high water and the damage, especially to harbor equipment, are here briefly described from an engineering point of view. The photographs were taken by the writer a few days after the disaster.

The path of the typhoon in the Osaka area is shown in Fig. 1. At Muroto the measured atmospheric pressure was 684 mm. (26.93 in.), which is believed to be the lowest ever measured at a land observatory. The maximum wind velocity at this location was 45 meters per sec., or 100 m.p.h. In Japan the wind velocity is customarily stated as the mean value during a 20-min. interval. The maximum instantaneous wind velocity at Muroto was 60 meters per second, or 134 m.p.h.

At the Osaka observatory the lowest pressure was 715.8 mm. at 7:55 a.m. (Fig. 4). The maximum wind velocity at this point was estimated at about 30 m. per second (the anemometer being damaged so that accurate measurement was questionable), but here also an instantaneous maximum velocity of 60 m. per second was recorded just before the anemometer was broken at 8:03 a.m. The direction of the wind at this time was from the south.

FIG. 1—PATH of the center of the typhoon near Osaka, Japan. The lowest atmospheric pressures and the times when they were recorded at several observatories are shown.

Many large structures, especially wooden schools, collapsed, and many children were killed or injured. A passenger train was overturned on a girder bridge while it was crossing the Setagawa river near Kyoto (Fig. 1). In some other districts flooded rivers caused damage. But the heaviest loss was due to the inundation of the industrial center of Osaka by the extraordinarily high water caused by the typhoon blowing in from the south channel.

Abnormal high tide

On the day of the typhoon the normal high water was at 4:55 a.m., and it was about three hours later that the typhoon struck the city. Fig. 3 is the record of a tidal gage some 2½ miles north of the center of the harbor, the low-water level of ordinary spring tide being taken as zero. The self-recording tidal gages in the harbor were broken, so that no accurate record is available, but from observation it is estimated that the water level reached + 4.56 m. (17 ft.). As the high-water level of the ordinary spring tide at Osaka is + 1.44 m. and the reclamation level is at + 2.30 m., the low-lying land was inundated to a depth of 2.26 m.

Damages to harbor equipment

Steamers and barges that had been moored to the quay walls or at the

FIG. 3—TIDE LEVELS recorded on gage at Osaka located as shown on key map which also indicates position of harbor breakwaters and the landing pier.

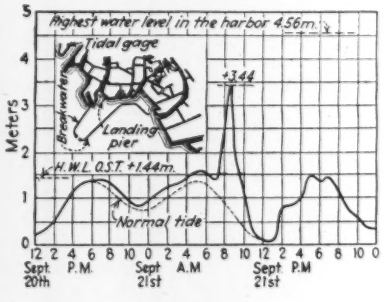
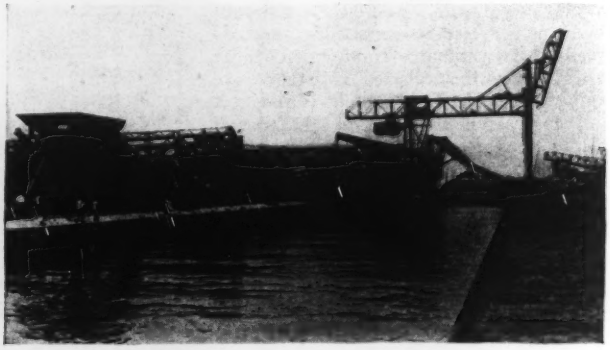


FIG. 2—IN THE WAKE of Japan's disastrous typhoon of Sept. 21, large ships were left on shore, and harbor equipment such as the large transporter crane were damaged and wrecked.



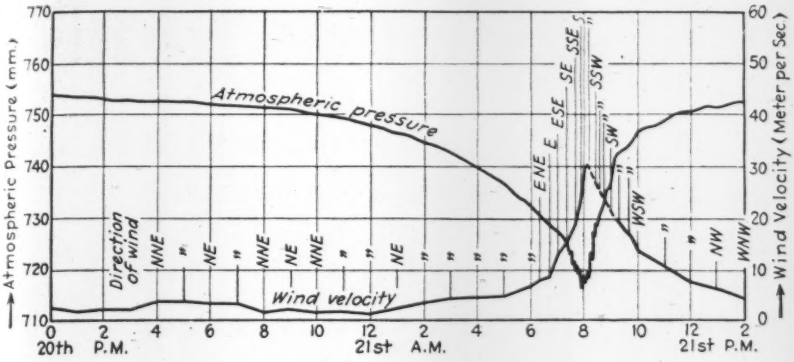


FIG. 4—RECORD OF ATMOSPHERIC PRESSURE, wind velocity and wind direction at Osaka observatory. Wind velocity between 8:03 and 9:00 a.m. on Sept 21 is not recorded because of damage to the anemometer.

buoys in the harbor were set adrift and caused much damage to structures along the coast. Steamers left on the coast after the storm had an aggregate tonnage of 23,000, one of the largest having a displacement of 3,145 tons. It is shown in Fig. 2.

The landing pier at Osaka, which had a length of nearly 1,700 ft., was swept by the steamers that had been moored to it, and broke into three separate parts. It consisted of steel pipe piles and a steel beam deck 27 m. wide at El. + 3.32 m. Some transporter cranes fell down (Fig. 2) in a collision with drifting barges.

The sheds along the quay walls were inundated, and the lower part of the walls, which were made of corrugated mortar slates, were destroyed. The top level of the harbor breakwater was about 2 m. under the highest water level, and many of its concrete blocks were displaced. Some steamers are said to have been thrown over the breakwater from the outside at the time of the high water.

In the harbor of Kobe (Fig. 1) floating landing pontoons of reinforced concrete moored to a solid concrete bulkhead were heavily damaged. During the high tide, the bottom of the pontoons struck the top of the bulkhead, and nine pontoons out of seventeen were inundated, while four sank.

Early American Canal Tunnel Restored for Historic Value

MORE than a century old and ranking as an early American engineering achievement, the Union Canal Tunnel, one mile west of Lebanon, Pa., which was an important link in the canal system of that region, has been restored because of its historic value, through the efforts of local citizens and the CWA. The 730-ft. tunnel carried the canal under a hill when this form of transportation was used extensively for moving lumber, grain and other products over an extensive canal system in the state of Pennsylvania. For many years the old canal has not been used, but the tunnel has remained practically undisturbed, and its unusual historic and engineering significance resulted in the restoration.

The tunnel was built in 1822-'23 by Simeon Guilford, the engineer in charge of much of the canal work. The canal extended about 72 miles from the Union Waterworks along the Swatara Creek to Pine Grove in the Schuylkill coal regions. During the construction of the canal it is reported that Guilford discovered and used a cementing material made from argillaceous limestone, which was considered an important development and resulted in the establishing of an early cement plant to produce this material. At one point on the canal a rise of about 80 ft. was provided by the installing of nineteen locks in a distance of about 3 miles. The walls of these locks were nearly 4 ft. thick, with an inside facing of dressed limestone.

The tunnel was an important feature of the canal system, and the driving of this bore through the solid rock under Gravel Hill, near Lebanon, with the simple tools and explosives of the time, was an outstanding engineering feat.

The canal was completed in 1828, and for many years canal boats of 25- to 28-ton capacity carried an extensive traffic of coal and other commodities, through the region of central Pennsylvania. In 1856 the canal was enlarged and the locks were reduced in number from nineteen to sixteen, with dams constructed across the valley at each lock site, to impound larger volumes of water. After the enlargement of the canal, boats carrying from 75 to 80 tons were used. With the construction of railroads into this region, the use of the canal diminished and finally stopped.

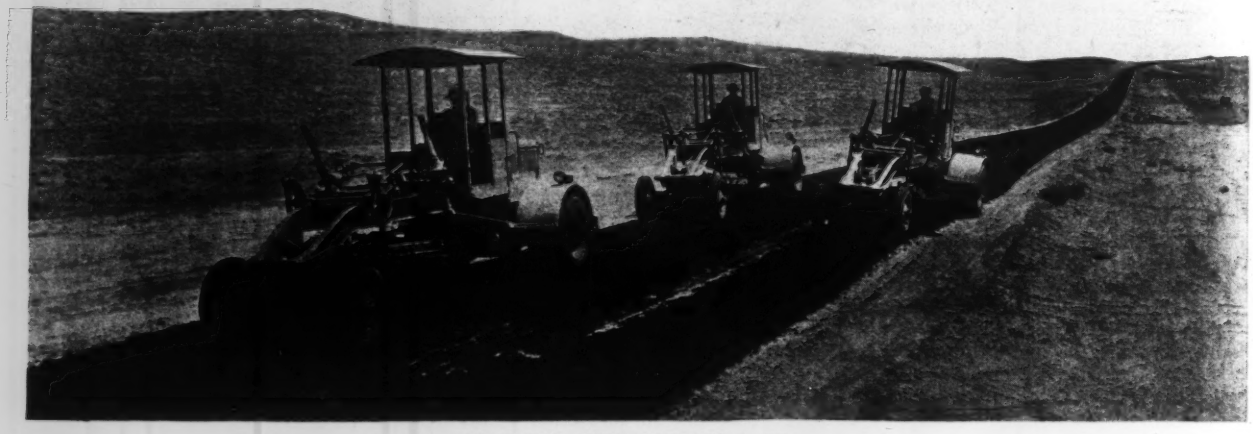
The recent undertaking has restored the old tunnel to something like its original appearance, and a bronze marker has been placed on the hill over the tunnel to mark this engineering relic.

Century-old tunnel 734-ft. long which was an important link in the canal system of Pennsylvania from 1830 to the coming of the railroad.

Toward Better Bituminous Roads

A survey of tar and asphalt roadbuilding discloses some creditable developments with many gaps in knowledge and practice that need to be closed up, according to John S. Crandell, professor of highway engineering, University of Illinois, Urbana, Ill.

THE LONG USE and the variety of uses of tar and asphalts in road construction place them among the most important of roadbuilding materials. Roadbuilders in general, however, have less acquaintance with the properties of these bituminous materials probably than with any other material except the natural soil. The result has been a multiplication of practices that exceeds all bounds of engineering reasonableness. In the last few years an earnest attempt has been made toward simplification, with the result that bituminous-road construction is becoming a controlled operation. That more progress is necessary is indicated by the following article, compiled from an interview with Professor Crandell, who has made a particular study of bituminous roadbuilding practice.



ROAD-MIX CONSTRUCTION in Wyoming, using three auto-bladers. This outfit scarifies the base and processes the surfacing at a rate of 3,600 ft. a day.

In general, what improvement is most demanded in bituminous-road practice?

▶ Our practicing highway engineers should realize that it is high time to study the subject of bituminous materials. There are so few of them who know anything about asphalts and tars that it is astonishing to have as many good roads of these materials as we now do. Indeed, this would have been impossible had it not been for the industries themselves, which have placed good service men in the field to instruct their customers how to use the particular material purchased. In no other line of engineering has this been carried to so great an extent, and it does not look well for engineering to see our highway designers and builders almost wholly dependent on salesmen for their technical information on the materials of construction.

I believe that not one highway man in ten knows the difference between tars and asphalts, and that not one in a hundred has ever read any of the volumes of *Proceedings* of the Asphalt Institute or of the Highway Research Board. Yet here are articles of the most valuable kind which, to the man engaged in bituminous road work, should be as well known as the principles of mechanics.

Do bituminous roads call for any differences in design practice?

▶ Owing to the fact that sheet asphalt pavements are generally laid on a portland cement concrete base, the idea prevails that all bituminous pavements should be so constructed. Nothing is further from fact. If the history of some of the old successful bituminous pavements is examined, it will be found that they were laid on bituminous concrete, waterbound macadam, gravel or other non-rigid bases. Furthermore, it will be evident, if they are dug up, that these bases are in most instances not very thick. And yet they are carrying heavy traffic with slight cost for upkeep. They are good and have lasted for years because the subgrade is good—and that is the answer to any pavement's life.

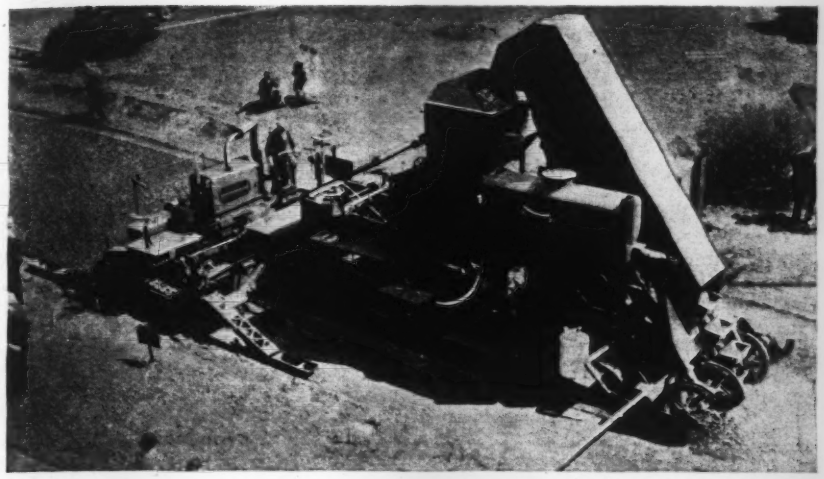
The bituminous surface need be designed only to take the usual wear of traffic and to transmit the load to the subgrade. If the subgrade is not stable, then it should be stabilized before an expensive surfacing is applied. It is the opinion of those who have really studied the subject thoroughly that depths which are necessary for concrete are not necessary for bituminous surfaces placed on good foundations.

Those who are interested may read the research study of Prof. W. S. Downs, West Virginia University, in which will be found a formula for the thickness of a pavement.

$$t = \sqrt{\frac{P}{\pi S}} = .0564\sqrt{\frac{P}{S}}$$

where t = thickness of pavement in inches, P = unit wheel load in pounds, and S = safe bearing power of the subgrade in pounds per square inch.

The value S may be fairly accurately determined for the worst part of the subgrade, and an ample factor of safety is then provided for the remainder. As B. E. Gray points out, "If the subgrade has a high bearing power, the pavement may need be only an inch thick, or just enough to resist abrasion and to provide waterproofing of the subgrade. Thus a macadam, gravel or sand-lay subgrade with surface treatment serves ade-



BITUMINOUS ROADS are built complete with this machine, which travels down the subgrade, picks up the aggregate, takes on bitumen, mixes the two and spreads and compacts the mixture into a finished surfacing.

quately in many locations." The classic example of this is the Grand Boulevard and Concourse in the Borough of the Bronx, New York City, a waterbound macadam that was surface-treated for over twenty years with light refined tar and carried as high as 20,000 vehicles daily, including solid-tire buses. Such demonstrations, and there are many, show that the design of a bituminous pavement need not follow that of the rigid type. In locations where uniform sand or gravel subgrades are available, 2 to 4 in. of hot mix may take the heaviest traffic over long periods. Our old ideas on design need revision.

What is the condition of our specification practice?

► We are living in an age of specifications. Some of our foreign engineering friends express great surprise at the mania we Americans have for buying everything by specification, and they hint that perhaps we might let the manufacturer supply the material that he knows will work best under the given circumstances and then hold him responsible for the results. In the matter of bituminous materials the writer is inclined to agree.

Some of our states have even gone to the extreme of writing the specifications for the individual constituents of cutbacks. That is all very well for certain materials, such as steel, aluminum and the like. But for bituminous paving compounds it is about as useful as writing a specification for potato salad, and then trying to tell the cook the specifications for the potatoes, onions, mayonnaise, salt, pepper, eggs and celery seed while leaving out of account entirely the cook's qualifications. This simile is not far-fetched. The manufacturer of bituminous products knows his materials, and he knows how to blend them to produce a desired result. To tie him down to hard and fast specifications of ingredients may cause him as much trouble as the cook experiences when his specification tells him to use so many white onions and he knows at that time of the year that yellow ones would be far better. As A. E. Kelly, chief, division of tests, Bureau of Public Roads, says:

> Neither the tests which have been included in the scheme, nor any of those which have been excluded, give all the information desired with respect to the quality of products of the slow-curing type. Materials of this character are produced from many fields. The finished products are the result of different refinery processes, and frequently a single product may be a blend of materials produced by different methods. It is generally recognized that there may be a considerable difference in the service behavior of materials of this class, furnished from different sources, even though they may all comply with the requirements of the most adequate specifications which we are able to write at the present time.

In other words, Mr. Kelley tells us very plainly that no matter how carefully you draw the specifications you do not know how the resulting product will act on the road. And this is true. But Mr. Kelley says that this fact is generally recognized. And that is *not* true. Those who have studied the matter know it, but the rank and file not only know nothing about it, they are certain to believe the manufacturers are all crooked if told of it. The manufacturer should be allowed ample leeway to make materials that he can and will stand back of. Many of the fly-by-night concocters of cutbacks and emulsions would be weeded out if producers were forced to make good on the performance of their products instead of being "specificationed" to death.

It would be highly desirable to have simplified specifications for bituminous materials adopted by the government, the states, the counties and the municipalities, and a movement is under way at present to secure this. Some progress has been made, and good men are at work on it.

How do you explain the increased use of emulsions and cutbacks?

► The bituminous emulsion has become somewhat popular in some quarters because of the ease with which it may be used. Asphalts and tars may be emulsified, but the former are being pushed more vigorously than the latter. Good results have been obtained with both materials. Some highly interesting papers and discussion may be read by those who want to buy emulsions, in the *Proceedings* of The Asphalt Institute, the Asphalt Paving Technologists Association, the American Society for Testing Materials and The Highway Research Board.

For the small maintenance crew the emulsion is sometimes very handy. One conspicuous advantage that it has over the cutback is that the aggregate may be damp or even wet, and still good results are possible. A decided disadvantage is that many emulsions are ruined if the temperature drops to 32 F. Again, emulsions are to some extent erratic in their action. The stone coating quality of emulsions varies with the stone itself and with the emulsion. It has been suggested that each laboratory should have reference stones for testing purposes. And it has been held that many varieties of emulsions must be kept on hand to meet the differences in stone quality. A German author says that the water in an emulsion liberates varying concentrations of alkali on the surface of the stone aggregate, and that this influences greatly the performance of the emulsion. Humidity, temperature and time all play their parts in making an emulsion job a success or a failure.

The emulsion is in competition with the cutback. But, if it is to become as dependable and useful, then much study and investigation must ensue. The cutback today is a product that can be depended on to do what you buy it to do. But, it must be recalled, this was not always the case, and the emulsion is where the cutback was fifteen years ago, so far as certainty of results is concerned.

Except for MC-1 (described elsewhere) not much change or improvement has been made in these materials for years. The slow-curing types have made headway in sales because opportunities for their use have been discovered. An excellent short paper by Prevost Hubbard entitled "Cutback Asphalts, Their Characteristics and Use," should be in the hands of those who use or contemplate using these materials. Another paper entitled "Specifications for Liquid Asphalt Products," by E. F. Kelley, should be read and studied. J. T. Pauls, senior highway engineer, Bureau Public Roads, presented an excellent

paper on "Mixed-in-Place Gravel and Crushed Stone Roads in the West" (Ninth Annual Asphalt Paving Conference, 1930) which should be carefully perused by *Engineering News-Record* readers west of the Mississippi, since it will clear up some confusion that may exist in their minds after they have read of or heard talks on the subject by eastern engineers. Mr. Pauls also describes some tests, such as the "swell test," the "emulsification test" and the McKesson & Frickstad formula for the amount of oil to be added to a road.

What is the situation in respect to priming bases and subgrades?

► Painters learned long ago that prime coats are essential. The primer is said to "tooth in" to the new or the old surface and thus prepare the way for the next coat. The tar industry early recognized this fact, and the very light tars that have been used for the past 30 years are really primers. It is to them that the success of tar surface treatments is largely due. In order to produce a suitable primer, it was the practice to blend coal tar and water gas tar, sometimes using half of each. Such a light tar, when applied to a gravel or a macadam road, penetrates not only the voids between the individual pieces of aggregate but in many cases even the aggregate itself. Furthermore, the dust particles that always are present in such roads are surrounded and covered by the primer and cause no trouble when the second coat is applied. Dust repels a heavy tar or an asphalt, and causes a "balling up" to take place that completely upsets the mix, prevents the binder from adhering to the aggregate and produces lean spots in the surface that make the road or pavement ravel. Hence a primer that eliminates such troubles has been of great importance.

The asphalt industry admitted that the tar prime coats were invaluable, but until two years or so ago nothing had been developed to compete. In fact, on many of the jobs it was and is customary to apply a tar primer and follow with an asphalt seal coat. Many hundreds of miles were surface-treated this way. An asphalt primer has now been produced which apparently is satisfactory. It is known as MC-1 in the Bureau of Public Roads specifications. It is a cutback asphalt which, upon distillation to 680 G., yields a residue with a penetration of less than 300. The Bureau of Public Roads specifications are as follows: viscosity, Saybolt Furol at 77 F., sec., 40-150; total distillate to 437 F., per cent by volume, 10-; total distillate to 600 F., 25-; total distillate to 680 F., 50-; penetration of residue, 100 g., 5 sec., 77 F., 70-300; ductility of residue, 77 F., 60 cms.; solubility of residue in CS_2, 99.5 per cent.

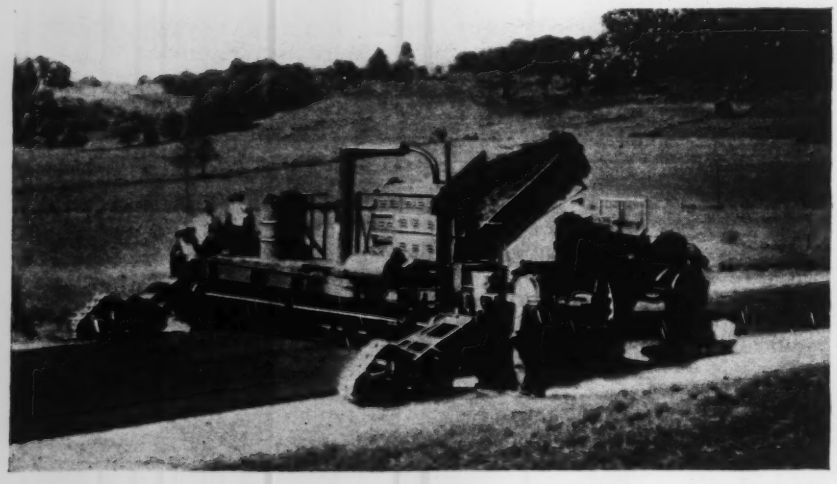
Is surface treatment of earth roads making real progress?

Very little has been done to date to make the earth road satisfactory under treatment. It is true that millions of gallons of oil are yearly spread over our earth roads, Illinois alone using as much as 50,000,000 gal. during the season. But the results are far from what they should be for the money expended. Dust is kept down during part of the year, and the roads are usable except during the spring break-up, when they frequently are worse than their untreated neighbors. But no lasting results are to be seen. The bituminous industries have a tremendous field before them, but they have been asleep.

The asphalt primer has been somewhat successful in the treating of sand-clay roads, and even earth roads. Light tars have occasionally been successful on the latter, as is attested by the treatment some years ago of several miles of streets in Syracuse, N. Y. Yet the same treatment with the same materials was unsuccessful elsewhere. Real research is needed here, and the cost would be trifling if the results were satisfactory. The trouble has been that the selling of oils and tars has been too easy, and the manufacturers have not been forced to bestir themselves. It will take foreign competition to jar them loose, just as happened in the case of the emulsion business.

Some account of what has been done with asphalt priming material has been presented by W. H. Foushee, Jr., bituminous engineer of the North Carolina highway commission. He has noted particularly the work on a clay gravel base and mentioned experiments on "various types of soil roads." The Bureau of Public Roads has also presented some information concerning similar work. The experiments with tar primers and asphalt surfacings have also been described.

FINISHING MACHINES have been developed that will spread and smooth bituminous surfaces to meet modern requirements for smoothness.



What progress has been made in mechanical mixers and spreaders?

► In no other field of endeavor has the bituminous industry been so far behind the times as in that of mechanical aids. Organized labor cannot point here and say that this industry has eliminated hand labor. So far as the road surfaces are concerned, it would be well if it had done so, for one of the reasons that many of the bituminous roads are uneven in contour and in texture is that they have been built almost entirely by hand. With the advent of high-speed vehicles, it has become apparent that bituminous roads, if they are to stay in the picture, must be made as smooth-riding as modern concrete and brick.

This led to the recent introduction of road-finishing machines, roadbuilding machines and adequate mixing plants. The sloppy, haphazard mixing plants of the dark past must be scrapped. The weighing devices that won't weigh correctly must be junked. The jerky, badly-handled roller must be superseded by a modern type, and operators must be educated to run them. Finishing machines that produce smooth-riding roads must be bought and used. The tremendous mileage of low-cost roads still to be built calls for machines of suitable design.

The retread type of road has shown most decidedly that traffic itself irons out a bituminous road to the smoothest surface obtainable. It is a mistake to roll such a road if a reasonable amount of traffic comes on it soon after it is built. And it is the construction of this retread, or mixed-in-place type, that calls for mechanical aid. A very few machines have been built that creep along the prepared subgrade, gather up the aggregate from windrows, take on a supply of bitumen, mix the ingredients, spread them, tamp them and pass on down the road. Such machines are expensive in the first cost, but they can be operated cheaply, have a tremendous capacity and do good work. The engi-

neers engaged on either mixed-in-place gravel or macadam should look into this matter and become acquainted with recent developments.

The mechanical finisher is now a usable machine, capable of giving excellent results provided the machine for the job is selected with due care. There are three types, and the engineer in charge of the work should see to it that he chooses the type best adapted to his needs. The finisher produces a much smoother surface than hand raking and tamping, and there is no excuse why its use should not be demanded.

The modern distributor is a far cry from the old tank wagon. If improvements in bituminous-road machinery as a whole had kept pace with the distributor, the industry would be in better condition today. The new distributors are very efficient, reasonably simple in operation, and they do what they are supposed to do. Since there are different types, they should be examined carefully, and the manufacturers should be interrogated before the purchase of such expensive equipment. Demonstrations should be arranged, as it is thus possible to see defects as well as points of superiority. The operators should, if possible, take some instructions from the manufacturer.

What improvement has been made in non-skid properties?

▶ The skidding characteristics of road surfaces have always been of great interest to the roadbuilder as well as to the motorist. At the 1933 annual meeting of the Highway Research Board, reports were presented of two investigations that were carried on during the year. R. A. Moyer, associate professor of highway engineering, Iowa State College, reported on the skidding characteristics of road surfaces, and a paper entitled "Coefficient of Friction Between Tires and Road Surfaces" was given by K. W. Stinson, associate professor of automotive engineering, and C. P. Roberts, assistant professor of mechanical engineering, Ohio State University. The investigations, although far from complete, show some decidedly interesting data.

Tests were run on many different types of surfaces. "In general, a marked decrease in coefficient of friction was noted with increase in speed, although the reverse was true in the case of the gravel and the cinder surfaces." In other words, the faster you travel over gravel roads the safer you are from skidding. One of the most important points brought out was that on wet pavement surfaces the coefficient of friction for skidding straight ahead at 30 m.p.h. is higher for bituminous surfaces than for other types. The sandpaper texture of bituminous surfaces is given as the reason. This finding upsets the commonly held notion that bituminous pavements are more slippery than others when wet. But it must be recalled that years ago Major Besson, then in charge of highways in Washington, D. C., stated that in his opinion all pavements are reasonably safe from skidding if they are kept clean, and that the data he had collected showed no more skidding accidents on one type than another. However, in these recent investigations we have the following figures given by the Ohio investigations (straight-ahead sliding coefficients of friction between non-skid tread tires and the various wet road surfaces, tested at 30 m.p.h.): bituminous concrete 0.54 and 0.42; sheet asphalt 0.41; portland cement concrete 0.41; vertical fiber brick (clean) 0.52; vertical fiber brick partly covered with asphalt 0.23; repressed brick, tar filler, 0.35; repressed brick partly covered with asphalt filler 0.24.

In these investigations there was no record made of the aggregates entering into the various mixes nor of the bituminous materials themselves. Little was noted concerning methods of construction, age of the road, the maintenance history, weather conditions, and so on. Furthermore, not enough tests were run on the various types to assure freedom from error. However, what has been accomplished is well worth while, and further reports should be studied carefully when they appear.

Road-Railway Grade-Separation Program in Wisconsin

Progress and cost of eliminating 76 railway grade-crossings in Wisconsin undertaken as an unemployment-relief program

By M. W. Torkelson

Director of Regional Planning, Wisconsin Regional Planning Committee, Madison, Wis.

THE EXTENSIVE PROGRAM of public works to consist quite largely of highway and railroad separations of grade, reported to be contemplated by the federal government, is reminiscent of the emergency unemployment-relief program carried out in Wisconsin beginning in 1931, which was still active in 1932, continued on a small scale through 1933, and of which some of the last few remaining financial transactions are now being completed. The program was sponsored by the then newly elected governor, Philip F. LaFollette. At the time of his inauguration, January, 1931, the depression had lasted about fifteen months. It was then thought that the depression would not be of long duration and that a construction program such as would be practicable to carry out along with other regular highway work then projected would be of material help for the wage earners.

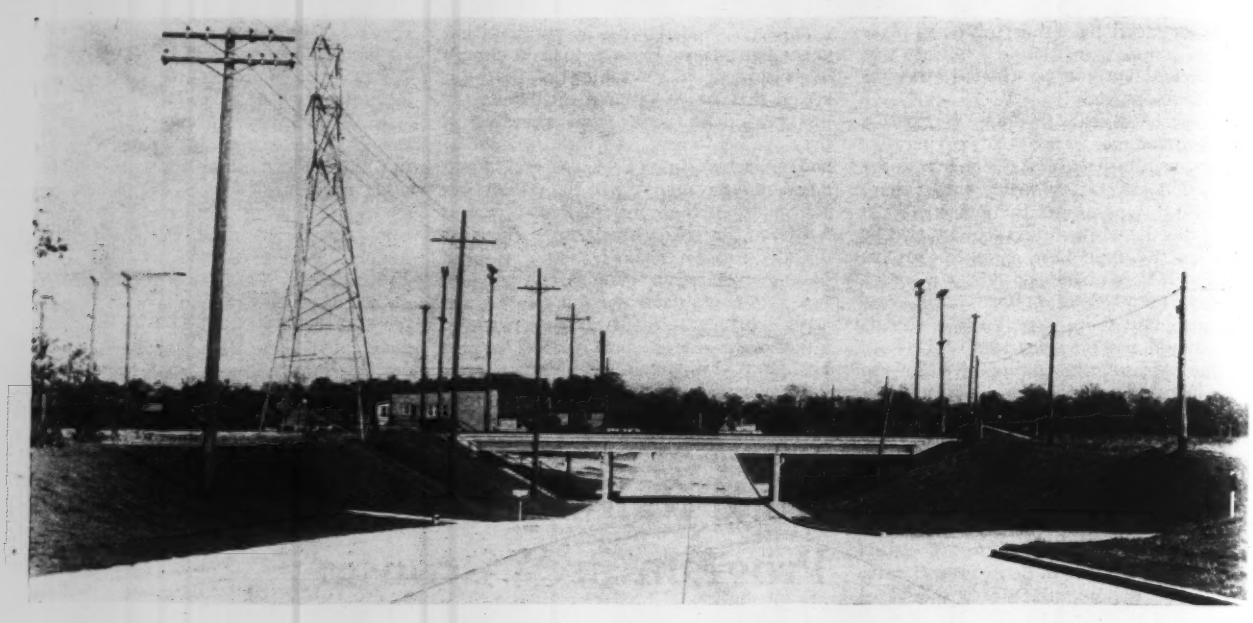
It was decided to concentrate the construction as much as possible on railroad separations of grade, as it was felt that the amount that would be returned to the wage earners in wages would be greater in the case of structures than in the case of pavements. It was also felt that there were many railway separations of grade that it was necessary and desirable to build, which were located close to industrial centers where the depression was most keenly felt and where there was the greatest number of unemployed wage earners. To minimize delay, it was considered necessary to eliminate the red tape usually involved in negotiations preliminary to work of this character. Accordingly, a bill designed to carry out these objectives was drawn and introduced promptly after the legislature convened.

This bill put the work in charge of an emergency commission for unemployment relief (referred to as the Unemployment Commission) of five persons who would receive only their necessary expenses.

The commission, as provided for, was empowered, subject to the approval of the governor, to make all arrangements necessary and expedient to carry out the purposes of the act. The commission was directed to negotiate with the authorized officers of each railroad company as to the grade crossings to be separated, the respective proportions of the cost to be borne in each case, and to make such arrangements and agreements as might be necessary and advisable for carrying out the work. All state officers and commissions were directed to cooperate. The act became effective on April 1, 1931, and the commission was appointed the following day.

Projects undertaken

In the meantime studies had been made to determine the specific projects to be carried out, and negotiations had been under way between the representatives of the governor's office and the railways with reference to the program and the amounts that the railroads would contribute. Between April 9 and June 15 agreements were entered into with the various railway companies operating in the state. The number of



UNDERPASS road-railway grade-separation carried out by the Wisconsin Emergency Commission for Unemployment Relief.

separations projected with the respective railway companies and the extent of their participation was as follows:

Railway	No. of Projects	Total Railway Participation
C. & N. W.	28	$509,000
C., St. P., M. & O.	5	91,000
C., M. & St. P.	22	400,000
M., St. P. & S. St. M.	7	110,000
C., B. & Q.	5	91,000
C., N. S. & M.	4	80,000
M. E. Ry. & Lt. Co.	4	75,000
G. B. & W.	3	12,000
I. C.	2	25,000
N. P.	1	10,000

Prior to the time that the emergency program was undertaken, the highway commission already had under contemplation a number of projects, for which negotiations were under way and plans prepared. Others had been under consideration for considerable periods, and a large amount of preliminary work had been done. The railways were generally desirous of including these in their programs. In the case of others the situations had not been studied; consequently the preparation of the plans was longer delayed. However, the Unemployment Commission was able, within 24 days of its organization, to receive bids for the construction of 27 projects, for which contracts were immediately awarded.

Organization of operations

The emergency program of the Unemployment Commission was carried out simultaneously with the construction of a number of other similar projects that were not in the program. In some projects involving two railroads, one participated, the other did not. In the unemployment program the state highway commission acted as engineers under the direction of the Unemployment Commission. On the other projects associated with the program, the highway commission exercised its statutory authority. Acting under a provision of the law regarding any of the regular highway projects that might be so conducted as to carry out the purposes of the emergency relief program, the Unemployment Commission assumed direction of such projects, took over several projects and constructed them under its special regulations, which were designed to provide the maximum amount of labor on the job. Among these regulations were included the following:

1. That the workmen employed must be selected from the list of applicants certified by the industrial commission; those having the greatest family obligations were to be preferred.

2. That labor operations must be conducted in two six-hour shifts unless otherwise specified, but in no case might there be more than an eight-hour day, with time and a half paid for overtime.

3. That the workmen must be paid weekly by the contractor on the payrolls submitted to the industrial commission.

4. That the minimum wage for common labor must be determined by the industrial commission, in no case less than 40c. per hour.

5. That the materials for the project would be furnished by the state f.o.b. specified delivery points, all concrete aggregates must be unloaded by hand, and all steel reinforcing bars of $\frac{3}{4}$-in. size or under must be bent on the job. Crushed stone was specified where the extra cost was not more than the difference in labor cost between crushed-stone and crushed-gravel production.

The greatest delay in getting construction projects under way was incurred in the acquirement of necessary rights-of-way. In some cases these delays turned out to be considerable.

Work accomplished

While the program was under way, depression conditions became worse instead of better. The act provided that the state's proportion of the cost of the work would be financed out of an increase in the motor-vehicle fees from 2 to 4c. per gallon, collected between the time when the act became effective and July 1, 1931, with a further provision that the governor might apply such increase to the emergency program for a longer period in the event that it was found to be necessary. In view of the difficulty anticipated by the railroads in financing their portions of the cost, they were allowed until the end of 1933 to pay their full portions. Because of the increased difficulty in financing and because it developed that some of the projects were considerably more expensive than was originally anticipated, the program was not carried out in full, although the greater portion of the program was completed. Railroad participation was in proportion to the work carried out.

The accompanying table gives the cost of the projects by railroads. A few more items may straggle in, but they will be few and small. In general, the overhead crossings were of reinforced-concrete construction, although in some cases steel beams and girders were used in the track spans. In general, the highway roadway in rural districts was 28 ft. between curbs, although in some cases, in the vicinity of the metropolitan areas, the roadways were wider, generally 40 ft. In general, the sight distance over vertical curves was a minimum of 600 ft. In one case where the attainment of such sight dis-

GRADE-CROSSING ELIMINATION PROJECTS IN WISCONSIN UNEMPLOYMENT-RELIEF PROGRAM

(Including Projects in Which Railroads Participated and Projects in Which There Was No Railroad Participation)

Railroad	No. of Projects	Cost to Oct. 31, 1934	Railroad Particip.	Average Cost	Aver. R.R. Particip.
C. & N. W.	23½*	$1,891,600.23	$436,363.68	$80,493.63	$18,568.67
C. St. P. M. & O.	8	412,594.59	90,909.10	51,574.32	11,363.64
C. M. St. P. & P.	22*	2,000,029.60	337,272.76	90,910.44	15,330.58
M. St. P. & S. Ste. M.	6½*	452,996.49	70,000.00	69,691.76	10,769.23
C. B. & Q.	4	360,864.06	72,800.00	90,216.01	18,200.00
C. N. S. & M.	2	356,700.35	40,000.00	178,350.17	20,000.00
M. E. R. & L.	3*	248,622.38	75,000.00	82,874.12	25,000.00
G. B. & W.	4	208,679.24†	35,000.00†	52,169.81	8,750.00
I. C.	2	95,464.70	25,000.00	47,732.35	12,500.00
N. P.	1	99,521.09	10,000.00	99,521.09	10,000.00
Totals	76	$6,127,072.73	$1,192,345.54	$80,619.37	$15,688.75

*No. of Projects:
C. M. St. P. & P. ..... 21 projects and 2 joint projects.
C. & N. W. ..... 22 projects and 3 joint projects.
M. St. P. & S. S. M. ..... 6 projects and 1 joint project.
T. M. E. R. & L. ..... 2 projects and 2 joint projects.

†Green Bay & Western includes $23,000 estimated cost of work performed and paid for by railroad as its contribution on two projects. Actual figures not available. Of the total crossings, sixteen were subways under railways, and the remainder were overhead bridges.

tance was impracticable, it was reduced to 400 ft. In this case the width of the roadway was 40 ft. In general, the roadway in subways was 40 ft.

A substantial portion of the program was carried out in 1931, but there was still considerable construction activity on the various projects under way in 1932. The report of the supervisor of unemployment research for the industrial commission, who checked the payrolls, showed that on 24 structures completed by Nov. 7, 1931, the wages and salaries paid *on the job* amounted to 43.4 per cent of the total contract price.

Necessarily, the projects selected were those which combined necessity with feasibility to the greatest degree. Situations where it was possible to build the separation without involving a considerable highway relocation were few. The most of this class that remain are projects of such formidable proportions as to have been impossible to finance in the past. The separations that have been or are being built subsequent to the program are most frequently constructed as an integral part of a major highway project and not primarily because of the separation of grades. These are fifteen in number, of which:

1. Nine are new separations built as incidental portions of highway projects, where the highway improvement was the reason for the project.

2. Two are reconstructions of existing separations incidental to a highway project.

3. Two are reconstructions of existing subways that are dangerous because too narrow.

4. One is a new subway built to correct very dangerous grades and alignment on the former road that crossed the railroad on an overhead one block east.

5. One is a new subway built on a relocation 2 miles long, to avoid two railroad grade-crossings and one narrow subway.

These projects are a fair index of the manner in which the state's grade-separation program would continue normally.

However, indications are that the necessity of separating railroad (and highway) grade crossings is not becoming less. It is necessary, of course, to use judgment in selecting the projects, but no one can say when a serious accident will happen at any grade-crossing, and especially any crossing where there are high-speed trains. The question of separation is really one of priority. Careful study is needed to place the separations where the greatest good will result and to avoid the early construction of expensive separations of grades on railroads that are likely to be of little future importance. The physical character of the approach to a crossing—that is, clear vision, etc.—has little if anything to do with the likelihood of accident. The subway illustrated in the accompanying photograph is one of those constructed under the program. The view at the grade-crossing was reasonably clear. About two years prior to the program a serious accident occurred in which two passengers in an automobile and eleven passengers on the derailed passenger train were killed. There were property damage to the extent of $57,000 and very large claims against the railway company for damages. None of this would have happened if the subway now in place had been built at the time.

The manner in which this program was undertaken was such as to require many prompt decisions. On the whole, the program was well conceived and well carried out. While the utility of many of the projects was questioned, subsequent experience indicates that each one will serve a useful purpose. Perhaps better choices might have been made in a very few instances. But the one great lesson that the program does teach is the necessity of advance planning in such programs. Every major highway should be surveyed, and a study made of the relation of its location to cities and railways, as well as other factors affecting location. Actual plans should be drawn as far in advance as possible. The future field of the railways should be studied. Perhaps the greatest opportunity for the proper development of cities will be through the consolidation and readjustment of railway facilities in and near cities. If we have plans, we have the basis for intelligent consideration of any project; without plans we do not have such basis. With well-considered plans we will get the utmost for our money; with hasty, and consequently ill-considered, plans it will be difficult to avoid extravagance or waste.

Milwaukee Vacant-Land Survey Shows More Subdivisions Unnecessary

UNOCCUPIED PARCELS of land and front footage available for development in the variously zoned districts within the city limits of Milwaukee have recently been surveyed by the Board of Public Land Commissioners. Results indicated that vacant lots now existing will care for a population increase for many years to come.

The purpose of the survey was to answer the following questions: Is further annexation necessary to provide building sites? Are there enough vacant lots for future development in each of the zoned use districts? What is the relation of vacant to occupied lots? What estimated additional population can be accommodated? Is there a definite need for more subdivisions?

Of the 2,837 total "B" residence lots, 20.8 per cent were vacant. Of the 30,916 "C" residence lots, only 3.7 per cent were vacant; while of the 55,694 "D" residence lots, 38.6 per cent were vacant. Of the 20,132 local business lots, 28.7 per cent were vacant; and of 7,156 light manufacturing lots, 15 per cent were vacant. The average vacancy was 25.8 per cent of the total 116,735 zoned lots in the city. The industrial area is in acreage. Of 3,070 acres, 36 per cent were unused. Using the conservative figure of four persons per family and a conservative estimate of the extent to which existing vacant lots will be developed for residential occupation, it was estimated that 200,000 additional persons can be accommodated on present vacant lands. At the past annual rate of growth of 9,200 since 1880, it will take 22 years to absorb the present supply of lots.

With 30,076 vacant lots inside the city plus the many thousands outside, the commission concludes that there is no definite need for more subdivisions, but consideration should be given to dividing outlying tracts into ½-acre and acre plots on the homestead-subsistence plan.

Book Reviews and Notes

A monthly Commentary on Current Additions to the Civil Engineer's Library

Housing

HOUSING AND SLUM CLEARANCE IN LONDON—By Hugh Quigley and Ismay Goldie. Cloth; 5x8 in.; pp. 227; photographs and tables. Published by Methuen & Co., Ltd., London, England. Price 7s. 6d.

SLUM CLEARANCE AND REHOUSING—Paper; 9x11 in.; pp. 139; photographs, diagrams and tables. Published by P. S. King & Son, Ltd., London, England. Price, 10s. 6d.

THE DESIGN OF RESIDENTIAL AREAS—By Thomas Adams. Cloth; 7x10 in.; pp. 296; photographs, diagrams. Published by Harvard University Press, Cambridge, Mass.

CONSTRUCTIVE additions to the rapidly growing literature of large-scale housing are contained in three recently published books. Two relate to the situation in Great Britain, which to a considerable extent is influencing the program being developed in this country, while the third (the sixth volume of the Harvard city-planning series) is devoted to the design of residential areas.

The first report of the Council for Research on Housing Construction, devoted to slum clearance and rehousing, presents an excellent technical study of Great Britain's national housing problem, including not only the historical background of the present situation but an analysis of necessary changes in present policies and recommendations for a program of central-area rehousing in tenement flats. In Great Britain, housing has tended more and more toward the status of a public utility. The Council, whose membership comprises industrial leaders, engineers and architects, accepts this tendency as inevitable and desirable, so that its recommendations should be of great interest to American readers.

"Housing and Slum Clearance in London" is an historical account of London's various efforts to combat its slums, told in a narrative style. Although directed to the general reader, it mirrors the situation, which is told with more technical detail in the Council report, in an accurate and concise manner.

Mr. Adams' book on "Design of Residential Areas" analyzes the considerations that affect land development in urban areas and presents the broad principles and method of design. The control of land subdivision, zoning, civic and neighborhood patterns, land costs and statistical data on several theoretical designs are discussed. Because the problem is variously viewed in terms of the region, the city, the neighborhood and the individual dwelling by a man of wide experience in the planning field, the book is one of the most important of the Harvard series.

Hydraulic Principles

HYDRAULICS—By Ernest W. Schroder and Francis M. Dawson. Cloth; 6x9 in.; pp. 429; photographs and line cuts. Published by McGraw-Hill Book Co., New York. $3.50.

ALTHOUGH it bears the imprint of an American publisher, the present volume is distinctly a British work in appearance and in treatment. The author, who is professor at the Royal School of Engineering at Giza, Egypt, has as his purpose the presentation of a compact summary of the fundamental principles of hydraulics, and of the manner in which they are applied by the engineer. In this he has succeeded admirably.

The book is divided into two parts, the first devoted to the fundamental principles of hydraulic theory, and the second to practical hydraulic applications. In the first part are included discussions of liquids and their properties, hydrostatics, flow through orifices and over weirs, flow through pipes and in channels, dynamic pressures and rotary motion. These topics occupy the first hundred pages. The book's second part practical applications, which aggregates about 220 pages, takes up in order pipes and pipe systems, control of water in open channels, automatic-control devices, hydraulic turbines, pumping machinery, hydraulic transmission and storage of energy and hydraulic measurements. There follows a section of about 70 pages devoted to examples of hydraulic problems, a number of which are worked out by the author for the benefit and discipline of the engineering student.

The British flavor is made manifest in the book's typographical treatment and also by the emphasis placed on hydraulic mechanism. Quite naturally the author's selections of illustrative examples of hydraulic practice are exclusively of British installations. The British atmosphere thus created, however, by no means impairs the book's value as a treatise on hydraulics, for either the student or the practicing hydraulic engineer.

Discussions of topics that are but lately entering widely in the thinking of the American engineer, such as the Reynolds-Number concept and the subject of hydraulic similarity, are brief but very clear.

Miscellaneous Notes on Booklets and Reprints

ANTI-MALARIAL WORK in the Malay States is described in a series of articles in the *Transactions* of the Engineering Association of Malaya, 1932, Vol. IX. Kuala Lumpur, Federated Malay States.

THE FIRST PRINCIPLES of grain-elevator design are discussed in a pamphlet entitled "Bulk Handling of Wheat," by L. Boyd Mercer, Melbourne University, Glasgow, Melbourne, Australia. Price, 1s. 6d.

ENGINEERING AND CONTRACTING PROCEDURE FOR FOUNDATIONS is the subject of Manuals of Engineering Practice, No. 8, published by the American Society of Civil Engineers, 33 West 39th St., New York City. Price to members, 20c.; to non-members, 40c.

LIGHTING FOR CRANES is the subject of Part 2, Industrial Lighting, Technical Paper No. 15, Illumination Research, Department of Scientific and Industrial Research (Great Britain). Copies may be obtained in this country from the British Library of Information, 70 Madison Ave., New York. Price, 10c.

MECHANICAL PROPERTIES OF BRICKS and of brickwork masonry have been under study at the Building Research Station in England since 1927. The results of the studies are published in Special Report No. 22, Building Research, Department of Scientific and Industrial Research, Garston, Wadford, Herts, England. The price is 1s. 3d.

"DESIGN OF WATERWAY AREAS FOR BRIDGES AND CULVERTS" is the title of a 100-page bulletin issued by the Oregon State Highway Commission, Salem, Ore. (limited edition), which combines the result of some original research and a large amount of compiled data. Some of the subjects treated are: methods of proportioning waterway areas, computing waterway areas, methods of relieving backwater heads, effect of piers, deepening of channels due to constriction, ice effects, drift impacts, drainage tables and mathematical theory of scour.

RIGID-FRAME BRIDGE DESIGN for symmetrical single-span structures by a new, rapid and accurate procedure is treated in a booklet published by the American Institute of Steel Construction, 200 Madison Ave., New York City, and prepared by Walter A. Weiskopf and John W. Pickworth, consulting engineers, New York. Formulas for determining directly the horizontal component of the reaction are the key to the procedure. They are based on in-

genious equations that represent the true moment of inertia values of the variable-depth members quite closely.

RESEARCH ON THE RELATIVE RIGIDITY of welded and riveted connections carried out by Professors C. R. Young and K. B. Jackson at Toronto University is reported in a booklet available from the National Research Council of Canada, Ottawa, Ontario.

THE HYDRAULICS OF FLOOD MOVEMENT IN RIVERS is the subject of a 70-page pamphlet published as an engineering bulletin by the Carnegie Institute of Technology, Pittsburgh, Pa. The pamphlet was prepared by Prof. Harold A. Thomas of the Department of Civil Engineering, assisted by ten research engineers furnished by the Civil Works Administration. The study contains original material not published previously.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

DRUCKVERTEILUNG IM BAUGRUNDE —By O. K. Fröhlich. Paper; 6x9 in.; pp. 185; halftones and line cuts. Published by Julius Springer, Wien, Germany. Price 15 RM.

FIRST-ORDER TRIANGULATION AND TRAVERSE IN LOUISIANA—By O. P. Sutherland. Paper; 6x9 in.; pp. 169; maps, tables. Published by Superintendent of Documents, Washington, D. C. Price 15c.

THE FLOW OF WATER—By George Bransby Williams. Cloth; 10x8 in.; pp. 76; numerous line drawings. Published by Chapman & Hall, Ltd., London. Price 10s. 6d.

HYDROLOGY AND GROUNDWATER—Re-issue. By J. M. Lacey. Cloth; 6x9 in.; pp. 160; line cuts and tables. Published by The Technical Press, Ltd., London. Price 10s. 6d.

PRACTICAL ACOUSTICS FOR THE CONSTRUCTOR—By C. W. Glover. Cloth; 6x9 in.; pp. 468; line cuts, halftones and tables. Published by Chapman & Hall, Ltd., London. Price 25s.

STAHLBAU-KALENDER 1935—G. Unold. Cloth; 5x7 in.; pp. 323; diagrams and tables. Published by Wilhelm Ernst & Sohn, Berlin. Price, 4.50 RM.

STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (Michigan)—Flexible; 5x8 in.; pp. 343. Published by Michigan State Highway Department, Lansing, Mich.

STRUCTURAL DESIGN IN STEEL—By Thomas Clark Shedd. Cloth; 6x9 in.; pp. 560; halftones and line cuts. Published by John Wiley & Sons, Inc., New York, Chapman & Hall, Ltd., London. Price, $5.

TABLES AND OTHER DATA FOR ENGINEERS AND BUSINESS MEN—27th Edition. Compiled by Members of the College of Engineering of the University of Tennessee. Flexible; 3x6 in.; pp. 139; tables. Published by the U. of T. Co-operative Book Store, Knoxville, Tenn. Price, 75c.

VIBRATIONS CAUSED BY BLASTING AND THEIR EFFECT ON STRUCTURES—By Edward H. Rockwell. Cloth; 6x9 in.; pp. 69; halftones and line drawings. Published by Hercules Powder Co., Wilmington, Del.

WASSERKRAFTANLAGEN-I — Adolf Ludin. Cloth; 7x10 in.; pp. 515; halftones and line drawings. Published by Julius Springer, Berlin. Price, 33.50 R.M.

Letters to the Editor

Laying Off an Angle

Sir—In your issue of Oct. 11 Milton R. Eva requests the opinions of transitmen on the best method of laying off an angle.

In the case cited, where the angle was repeated six times, my method would be to mark a point on the line at each repetition of the angle. These points should be on a line approximately at right angles to the line of sight, and the average position of these points is taken as the final determination of the angle. By the average position is meant the arithmetrical mean of the distances of the several points from some fixed point taken as a datum.

In the case referred to it would be the sum of the distances of the six points from the datum divided by six. In practice this mean can be determined closely enough by inspection in many instances.

Mr. Eva mentions laying off an angle having odd seconds with a transit reading to minutes. For this the same method can be used. Care should be taken at each repetition of the angle to set the vernier as near as possible on the fraction of a minute called for, and it might be well to make the number of repetitions such that the last reading would come on a whole minute.

F. W. BATEMAN.

Clinton, Mass.,
Nov. 7, 1934.

* * *

Sir—In response to the request of Mr. Eva for a discussion of the subject of laying off an angle by repetition, I would suggest the following disadvantages in the method proposed by him:

1. The head chainman must look up the tangent of the correction angle and multiply it by the distance from the transit to the point. Usually this distance has not yet been measured, and the correction angle will be less than a minute and the tangent not given in the field tables for the exact seconds.

2. It is difficult to lay off the correction distance at right angles to the line from the transit to the point; for the short distance, if this distance is not laid off nearly at right angles, quite an appreciable error will result.

3. There is the usual chance for error in the calculations.

In the method outlined by Mr. Gohl the point C'' does not need to be exactly at right angles to the line from the point C' to the transit, as the fractional part will be exactly proportional so long as it is laid off on the line C' to C''; also this fractional part may be laid off by dividing the total distance proportionally, as, for instance, by folding a small piece of paper. It is not even necessary to measure the distance in feet or inches. No tables are required, and the distance to the transit does not need to be known.

On an extensive land and shoreline survey which we are now making we frequently find it advisable to use the methods outlined by Mr. Eva, but for laying off angles we use the method of Mr. Gohl.

On this work we measure all angles of the base traverse by repeating three times and record the result to the nearest 20 sec. In laying off an angle we repeat as many times as required to bring the sum to even minutes, provided it is three times or more. For example, an angle of 24° 10′ 20″ would be repeated three times, but an angle of 24° 10′ 30″ would be repeated four times. In the first case the final angle set off on the vernier would be 72° 31′ while in the second case the final angle to be set off would be 96° 42′ instead of twice the angle, or 48° 21′.

DAVID G. GLASS,
County Surveyor.

Wasco County,
The Dalles, Ore.,
Nov. 1, 1934.

Advantages of Patent Laws

Sir—Your editorial entitled "The Activated-Sludge Patent," in the issue of Oct. 18, 1934, reflects an unfavorable attitude toward patents which, in my opinion, is extremely shortsighted.

The patent laws in this country were enacted pursuant to the authorization granted to Congress under the Constitution to promote the progress of science and useful arts.

The purpose of granting patents is to stimulate invention and ingenuity and to encourage the disclosure of inventions to the public. Every enlightened government has a patent system, because in the absence of such a system the fruits of a man's inventive genius are immediately open to usurpation by others, and this tends to stifle advancement of the arts. Inventions which, under a patent system, are thrown open to public use after a specified duration of time would be kept secret or would not be made at all.

One of the reasons why we are enabled today to enjoy such things as automobiles, radios, motion pictures, household refrigeration, etc., as well as the thousand and one minor improvements in electric irons, vacuum cleaners, wide-flanged beams, and the like, is because inventors have been encouraged by a profit incentive to enter into and carry through all sorts of fruitful experimentation and research.

To make a real invention takes time and costs money, and very few of us will invest either unless there is a chance to profit by so doing.

FREDERICK BRIETENFELD,
Counselor at Law.

New York, N. Y.,
Oct. 24, 1934.

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November 22, 1934

Translating Results

CORRELATION of refined laboratory studies of the characteristics of mass concrete with routine, field-control testing always presents a problem in obtaining assurance that the final product is comparable to the material as designed. The unavoidable discrepancy between the two types lies in the impossibility of making the small test specimens that must be examined in the rush of field work directly comparable to the large specimens containing all sizes of aggregate that can be made and tested in the more leisurely laboratory work. The generally accepted expedient employed in bridging this gap is to obtain the small specimens by wet-screening of the mass mix, judging the quality of the concrete as it comes from the mixer by applying a factor determined through earlier comparison of like specimens with large specimens containing all the aggregates. In the past, studies of the relation between full-mix and wet-screened specimens have been limited by the cost and difficulty of preparing and testing the large specimens. Now this study has been greatly extended by exhaustive research made by the Bureau of Reclamation as a phase of the Boulder Dam project, reviewed in the article in this issue. The information constitutes an important advance in mass-concrete technique and gives designing engineers added assurance that reports they receive from the field office can be accurately interpreted.

The Railroads Contribute

NOW AND AGAIN the railroad bridge, erstwhile pioneer pace-setter in bridge engineering, comes back to demonstrate in dramatic fashion that courage, initiative and vision are still alive and at work in this important field which was inevitably eclipsed when highway building was undertaken on a grand scale. The Canadian National, with its ballastless, precast-deck and rigid-frame concrete bridges, is an example. The MK-T lift span at Bonneville, Mo., and the Southern Pacific crossing or Suisun Bay in California are others. Railway engineers have been leaders in developing the use of welding in bridge repair and strengthening work. The most recent example is the solid steel deck of the new Reading Company bridge near Catawissa, Pa. The solid deck is generally accepted as superior to the open-tie deck, but because of its much greater weight it has often been at an economic disadvantage. The solid deck, permitting the ballasted track to be continued across the bridge, improves riding qualities, assists alignment and removes the danger of damage to bridge and track from creep and expansion that exists when rails are spiked to ties that are a part of the bridge. Solid decks also remove the ever-present fire hazard. The new Reading deck, of welded interlocking-channel type surfaced with asphalt plank, is said to have effected a saving in weight of 1,600 lb. per linear-foot of bridge over a conventional solid deck. Service experience only will reveal how much of this advantage is cancelled by a possibly higher maintenance cost. For the present, the steel deck commands attention as an important development in railroad bridge design.

Avoid Another False Start

WITH CONSTRUCTION OPERATIONS shut down for four months on San Gabriel Dam No. 1 of the Los Angeles Flood Control District to allow further study of designs, this nine-year-old project has added a further chapter to its unique history. Much of the early history was unfortunate, if not unsavory, and included abandonment of the original site for the high concrete dam after extensive excavation work, with subsequent abrogation of contract, lawsuits, charges of bribery and conviction and imprisonment of a city official. Then, accompanied by almost continuous controversy and taxpayers' suits, the new site was selected for a record-size rockfill dam, a contract was let, and a million yards of overburden and rock were stripped and wasted from a quarry site which is now admittedly inadequate for material to meet specifications. More recently, there has been a change in engineering organization and consulting board. Now the work is to be stopped by agreement between Los Angeles County and contractor while the design is again restudied and probably modified. A "new deal" for San Gabriel Dam No. 1 is in order. The restudy, especially the field investigations, should be so exhaustive and the finding so conclusive as to produce a design that will have much more unanimous support of engineering opinion than was ever accorded any of the predecessors.

More Freedom to Hire

GREATER LIBERTY in working hours and selection of labor than is allowed by present PWA regulations was wisely urged by state highway officials at their annual meeting last week, as reported in our news pages. The need is based on sound principles of transportation service and the unfavorable experience of an eighteen-month trial of the present regulations. A road put under construction is normally a road removed from transportation service for which an inferior substitute is supplied by a longer and poorer detour. Technical improvements in materials and construction have in recent years been pointed toward a means for accelerating construction to reduce the period for which traffic would be hampered. The present restrictions on labor increase the construction period. Experience has proved definitely that it is time-consuming and expensive to allow frequent changes of working crews and an enormous labor turnover due to constant hiring and firing of men from local unemployment lists who cannot endure or become capable in construction work. The change to a forty-hour week and freedom to hire men from anywhere in the state is not drastic and will materially reduce the time that the traveling public is inconvenienced and put to extra expense by road-construction operations.

Getting Ready for Special Cements

THE AMBITIOUS RESEARCH PROGRAM on cement composition and its relation to concrete that has engaged the staff of the Portland Cement Association for the past three years is bound to be of inestimable value in the days to come. Special cements are in the ascendency—and for the good reason that some of them offer worth-

while advantages for certain types of service or exposure. But in breaking away from a single-standard specification for cement, both user and producer will have new problems to face. It is probable that extravagant claims will be made by specialty promoters; that engineers will be encouraged to ask producers for a different cement for every purpose; and that private specifications will be written in greater number than ever before. In order that any development and use of special cements may be as orderly and as free from impracticabilities as possible, vastly expanded knowledge of cement composition is required. Also the knowledge must be widely disseminated among engineers and contractors. The PCA studies are a valuable aid to this end. They substantiate, in a quantitative manner, views that have been held by cement specialists. And what is more important, they give the user a picture of what the various cement compounds contribute to his concrete in strength and durability. The user who takes the trouble to broaden his knowledge of cement chemistry now will be amply repaid when, as seems certain, he will be importuned to make a choice between some such products as Daisy Valley Blue and Lake Michigan Trical.

Crossing Elimination Planning

THE ACCOUNT in this issue of road-railway grade-crossing elimination in Wisconsin has special significance in view of the possibility being talked about in Washington of a federal appropriation of $125,000,000 for a national program to bring about similar traffic safeguards. Like the Wisconsin state program, that of the national government is being projected as an emergency means for quick employment, and the Bureau of Public Roads is now making a survey of projects that can be made ready for contract in ninety days.

Emergency planning, however, touches only the edges of the crossing problem. If the experience of Wisconsin can be assumed as representative, there should be no difficulty in disposing of $125,000,000 in needed crossing separations that can be quickly put into active construction. In brief, a temporary grade-separation program is comparatively easy to plan and prosecute.

The problem has a different aspect when considered as a continuing program. Questions of right-of-way, route relocation, order of importance, economic type and even road abandonment sharply reduce the freedom of quick action. For example, it is reliably estimated that about 30 per cent of the 250,000 present road crossings of railways can be avoided by reasonable route relocation. These route changes are not to be decided out of hand; their determination must await proper order and time as road systems develop to meet traffic requirements. Other examples can be cited, and all point to the same conclusion.

If the grade-crossing problem is to be approached along lines of national and state importance, broader planning than any that has been announced, or any that falls into emergency procedures, must be considered. Cooperative action of governmental agencies and private interests on a scale previously unapproached has to be invoked. The interest of the highway industry in securing the emergency appropriation at present hoped for should not be allowed to becloud the greater purpose of developing a consistent program of continuous grade-crossing elimination. This is the cause that the engineers of the industry have to make particularly their own. They have the duty of being program-makers and leaders in a transportation improvement that higher road speeds, streamline trains and an increasing highway-accident frequency are bringing into immediate prospect.

New Spirit in Transportation

THE ZEPHYR, new light-weight streamlined train of the Burlington railroad went into regular service between Omaha and Kansas City on Nov. 11 after several months of demonstrations and test runs. In taking over the regular run the new train is reported to have cut two hours from the running time of the standard steam train that it replaced; but as we pointed out in commenting upon the recent test run of the Union Pacific's new light-weight train from Los Angeles to New York (*ENR* Nov. 1, p. 567) it is the strength and condition of the track rather than the type of motive power that are the controlling element in railroad speed.

Steam locomotives for many years have been able to attain speeds closely approaching those of the new trains but have been compelled to operate at lower speeds in the interests of safety and riding comfort. Hence the radical departure from current practice and traditional standards that is found in light-weight streamlined trains is less of a new achievement in speeds and more one in reduction of transportation costs and in modernization of service. The latter in many ways is the more significant element of this new development in transportation. It is indicative of a new approach to the whole subject of passenger transportation, an effort on the part of the railroads to meet the competition of the private automobile, the bus and the airplane.

Direct economies of considerable magnitude can be shown for the new trains by comparing their operating cost with that of the steam trains displaced. To what extent these will be offset by indirect losses remains to be determined. So long as the new trains displace serviceable equipment that cannot be sold or put into other service—which will be the case quite generally—the actual cost of the new service will be its own operating and financing charges *plus* the outstanding carrying charges on the displaced equipment. Further, the introduction of trains of the newer type will make no appreciable reduction in the cost of operating plant for maintenance of the older motive power—engine houses, ash pits and water tanks—until many steam locomotives have been displaced.

The most encouraging aspect of the introduction of these radical departures in train design is its evidence of a new approach to the subject of passenger traffic by at least a few railroad executives. The whole history of railroad transportation in this country has been one of progress toward more and more ponderous equipment and toward longer and heavier trains. Introduction of the "gas car" into branch-line service a few years ago was the first departure from that tradition. Now we are witnessing a still more radical departure in the introduction of light-weight multiple-unit trains of a new design. Because of their low operating costs these units can be operated more frequently, thus meeting the competition of private car and motor bus. If the regeneration that these changes indicate is extended until it reaches the antiquated and bureaucratic passenger-tariff and ticket-handling departments, there is reason to expect a real revival in the railroad passenger business.

CURRENT NEWS

Highway Officials Urge 40-hr. Week At Santa Fe Meeting

(Special Correspondence)

THE American Association of State Highway Officials at their twentieth annual meeting at Santa Fe, N. Mex., Nov. 12-15 elected A. W. Brandt, Highway Commissioner, New York, as president. Ernest L. Bailey of West Virginia, Ed McDonald of Oklahoma, J. F. Ellison of Minnesota and G. D. Macy of New Mexico were elected vice-presidents for the first, second, third and fourth districts, respectively. W. W. Mack of Delaware was re-elected treasurer. Thomas H. MacDonald of the U. S. Bureau of Public Roads and C. B. Treadway of Florida were elected to the executive committee for five-year terms. The attendance was about 400 with official representation from all states except Connecticut, Kentucky, Maine, Massachusetts and Pennsylvania. Interest was well sustained.

The technical discussions which had been prominent in early meetings were absent, except from committee meetings. There seemed to be a tacit agreement that construction and maintenance practices are, in the main, well established, and require only minor refinements. The principal discussions revolved about two major questions, the first relating to financing the additional construction needed to provide reasonably adequate highway facilities and the second concerning policies to secure better use of the highways through the improvement of safety and coordination of highway transport with other forms of transportation.

Construction progress

President Worden's annual address and Secretary Markham's report referred to financial features, the sources of highway funds and the accomplishments of the past year. Thomas H. MacDonald of the U.S.B.P.R. covered the same ground. According to Mr. MacDonald state and federal road building provided 1,813,500 and 2,120,800 man months of labor, respectively, a total of 4,441,300, which is larger than any previous year. Estimating the indirect labor as 1.4 times the direct, the total was placed at not less than the equivalent of 880,000 men through the year, varying through different months. He recommended a 40-hour week on future work. On Oct. 27, 1934, 16 months after the $400,000,000 appropriation of June, 1933, became effective, 16,330 miles of new roadway projects had been completed, 7,880 miles additional were under construction and 2,845 miles more were definitely scheduled for construction, a total of 27,055 miles.

Mr. MacDonald emphasized the need of an adequate railroad grade-separation program, as a safety need and as a suitable part of a program of public works. He pointed out that statutes requiring large

(Continued on p. 672)

Bids Called for More Tunnels on Colorado Aqueduct System

Bids have been called for Dec. 17 on 10.05 miles of tunnel for the distribution system of the Colorado River aqueduct which is being built by the Metropolitan Water District of Southern California. These tunnels are west of the Cajalco terminal reservoir and represent the first units to be undertaken by the district on the distribution conduits which will convey water from the terminal of the main aqueduct to existing municipal systems. The work includes Monrovia Nos. 1 and 2 (schedule 1), 1.67 miles; Monrovia No. 3 (schedule 2), 6.08 miles, and Pasadena (schedule 3), 2.30 miles. The tunnels will all be 10 ft. in diameter and concrete lined.

Bids Received for First Dam on Muskingum Conservancy Program

Twenty-eight contracting organizations submitted bids to the U. S. Corps of Engineers for constructing the Tappan Dam which is the first unit in the program of 15 dams planned for the Muskingum Watershed Conservancy District. The low bidder was Sammons Robertson, Inc., Huntington, W. Va., on a figure of $387,450. Only six of the 28 bids submitted, according to report, were correct in every detail. The other 22 might have been ruled informal on a strict interpretation.

Work Halted on San Gabriel Dam To Permit Review of Design

Operations at the main quarry site on the Los Angeles County Flood Control District project, San Gabriel Dam No. 1, were halted temporarily on Nov. 14 for a period not to exceed 120 days while present plans for the structure are being modified. This action results from the recommendations in two reports on this rock-fill dam (*ENR*, Oct. 18, 1934, p. 510) and is expected to be followed by continuation of construction under revised plans and specifications.

The action is the result of agreement that the dam could not be completed according to present specifications with rock from the present quarry (No. 10). Whether the new plan should include modified slopes on the dam with specifications changed to permit the use of material heretofore rejected or whether rock from another quarry must be used are questions to be settled. Also, detailed plans must be submitted to the state engineer on any type of construction for which state approval is requested.

The West Slope Construction Co., contractor on the dam, is understood to have agreed that cessation of activity is not to abrogate their contract. The shutdown affects about 300 workmen engaged in quarry operations, the only crews to remain are those working on cutoff trenches, drainage tunnels, etc.

Permanent Board for National Planning Urged in Report

(Washington Correspondence)

CREATION of a permanent national planning board is the outstanding recommendation by the temporary national planning board which submitted "a plan for planning" to President Roosevelt, in a report, dated Aug. 1 but not released by the White House until last week. The board, of which Frederic A. Delano was chairman, was encouraged to "look forward down a broad way to another era of American opportunity" but "granted to those of a skeptical turn of mind that it is easy to yield too readily to eager anticipation."

"Standing apart from political and administrative power and responsibility, but in close touch with the chief executive, such a group of men (the new board) would have large opportunity for rumination and reflection upon national trends, emerging problems and possibilities, and might well contribute to those in responsible control, facts, interpretations and suggestions of far-reaching significance."

The Delano board's report referred with restraint to the "number, variety and profusion of plans and their lack of coordination" but cited "obvious conflicts of policy between the AAA crop restriction program and development of additional farm acreage through irrigation under the Reclamation Service." The board claims credit for reconciling this conflict, at least partially, in the appointment of a land planning committee by Secretaries Ickes and Wallace which held six meetings and contributed to the formulation of the program for withdrawal of submarginal land.

The plannings board's report will be followed by a series more specific in their findings by the Mississippi Valley Committee, the National Resources Board, the Federal Power Commission, a board of army engineers appointed to draft a plan for Mississippi River flood control and a committee named by Secretary Ickes to review the federal reclamation policy.

Lack of Police Protection Delays Highway Projects

Failure of St. Louis County authorities to provide sufficient police protection for men employed on county road construction projects totalling $299,000 has resulted in holding up the beginning of this work. Last year laborers employed on road work in the county, according to reports, were occasionally subject to interference by men claimed to be union organizers. This year the Bureau of Public Roads decided that funds would not be turned over to the county unless sufficient guards were available. Both union and non-union workmen were employed last year on county road work.

Acetylene Association Meeting in Pittsburgh

The thirty-fifth annual meeting of the International Acetylene Association, held in Pittsburgh, Pa., Nov. 14 to 16 was attended by 750 users and manufacturers interested in oxy-acetylene welding and cutting. Emphasis in the program was on steel mill and railway applications. Groups of papers were also given on the metallurgy of the oxy-acetylene process, on pipe welding and testing and on education and safety in welding. Philip Kearny of the K-G Welding & Cutting Co., New York, was elected president.

The Morehead Medal, awarded annually for outstanding achievement in producing or utilizing calcium carbide or its derivatives, was awarded to R. A. Witherspoon, vice-president, Shawinigan Chemicals, Ltd., Montreal, who has pioneered in the synthesis of organic chemicals from acetylene. Among the many papers given at the meeting, the report of the chairman of the oxy-acetylene committee, G. O. Carter, consulting engineer, The Linde Air Products Co., was particularly notable and of wide interest. It will be abstracted in some detail in a future issue.

Water Rates Raised to Cut Use When Town Supply Is Depleted

The water rates for the town of Creton, Iowa, will be raised this winter to about $6 per 1,000 gal. as compared to the present rate of $1.50 to effect a reduction in the use of water as the result of having only a 75-day supply available in the local reservoir. Last spring, before the drought and resulting water shortage, the town rate was only $0.35 per 1,000 gal. Recently the state emergency relief administration stopped the payments which had been aiding in shipment of water from Council Bluffs. At a recent election the voters turned down a proposal that the city purchase the system of the Taxpayers Municipal Water Co. for $185,000 in revenue bonds.

Holland Tunnel Traffic Exceeds 77,000,000 for 7 Years

On Nov. 13 the Holland vehicular tunnel under the Hudson River at New York had been in service for seven years and the traffic count during that period has exceeded 77,000,000. The vehicular movement during the past twelve months showed an increase of 25 per cent over the first year, according to the Port of New York Authority. Depressed business conditions during the past few years have shown some effect on traffic, but the decline never reached serious proportions. Since the spring of 1934, and particularly during the last three months, there has been an increase in traffic.

Pier and Shed Costing $1,150,000 To Be Started at Gulfport, Miss.

Financed by a PWA loan on bonds issued by the county, construction work has started on a new pier and warehouse project at Gulfport, Miss. The work will cost $1,150,000. The pier will be 1,790 ft. long, 196 ft. wide, and will be occupied by a warehouse 120 ft. wide.

Enforcement or Suspension of Code Requested by New York Contractors

ENFORCEMENT of the construction code by NRA or the suspension of Chapter II and that part of Chapter I affecting general contractors was urged in a resolution passed at a spirited meeting of 150 contractors of New York State held in New York City Nov. 19. The meeting was called by the New York State Administrative Agency, General Contractors Divisional Code Authority, in the interests of better administration of the code and to sound-out the sentiment of New York members of the industry regarding the code and its operations. The resolution climaxed a long evening session at which sixteen scheduled and half a dozen extemporaneous speakers were heard. In general, the expressions on the code's operation and administration were condemnatory.

Lack of enforcement was the chief cause of complaint, with lack of funds for administration following a close second. All manner of suggestions were offered, many advocating complete abandonment of the code. R. C. O'Keefe, of the Buffalo A.G.C. chapter, suggested that the funds collected from registration fees in New York be retained by state and local agencies in sufficient amount to properly administer the code, with any surplus to be passed on to national headquarters. Fred T. Delaney, Syracuse, stated that builders would welcome abandonment of the code. Raising of the registration fee to 1 per cent and designation of Westchester County as a local administrative area was recommended by R. DeMott of Bronxville.

M. E. Chamberlain, New York, defended the code, telling of the strenuous efforts made to establish area agreements and stating that if the spirit of the code were lived up to, its purpose would be accomplished. He mentioned the lack of cooperation of public officials in regard to code operations, especially in refusing to recognize a distinction in classes of construction work and attempting to force building trades rates on heavy construction work. Daniel Webster, New York, chairman of the Chapter II-A building committee, outlined the long struggle to have this subchapter approved.

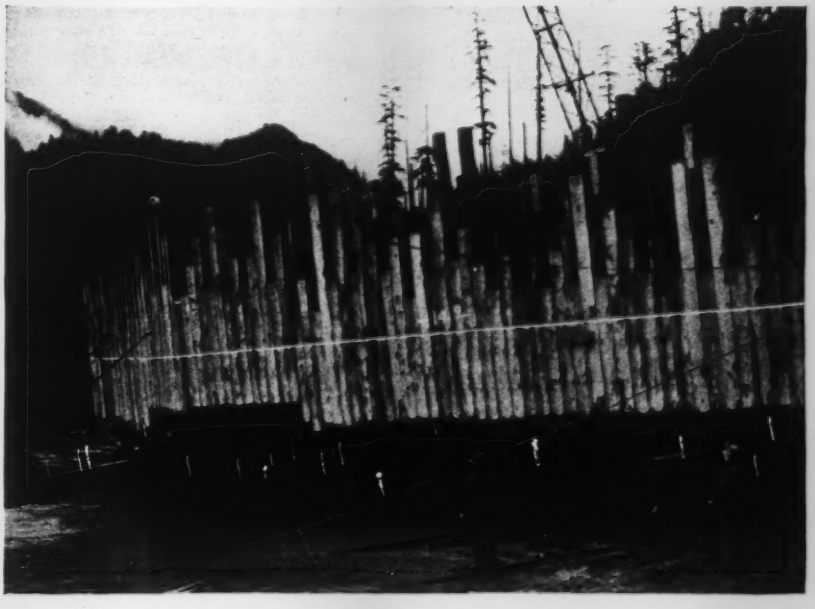
A restraining note was sounded by A. C. Tozzer, long associated with formation of the code. He advised that the codes were certain to be reenacted in some form after their expiration next June, and warned the meeting to work towards a workable and satisfactory revision. A simplification of the present code structure was advocated by several speakers, with the idea that the code contains certain features worthy of salvage, but that the cumbersome array of the multitude of chapters has rendered it unworkable.

A larger return of registration fees to local and state agencies was recommended by many. At present even collection of fees is hampered by lack of enforcement provisions, with the result that less than 75 per cent of contracts are being registered. Collection of fees is proceeding on a "please" and begging basis, rather than strict enforcement of this necessary provision of the code.

A committee of six was named by James Gibbons, director of the New York State Agency, to consider the suggestions made at the meeting.

FIRST COFFERDAM CRIB FOR DIVERTING THE COLUMBIA AT BONNEVILLE

Ready for launching, this timber crib cofferdam will form the first section of the river diversion plan at the Bonneville Dam site on the Columbia River. The crib is 60 by 110 ft. in plan and was 16 ft. high when launched. After floating to position these units are filled with rock and sunk into place. This particular crib will form the start of the downstream end of the river arm of the cofferdam and will be built up to a height of 56 ft. The Bonneville Dam design and construction program were described in detail in *ENR*, Nov. 1, 1934, p. 547.



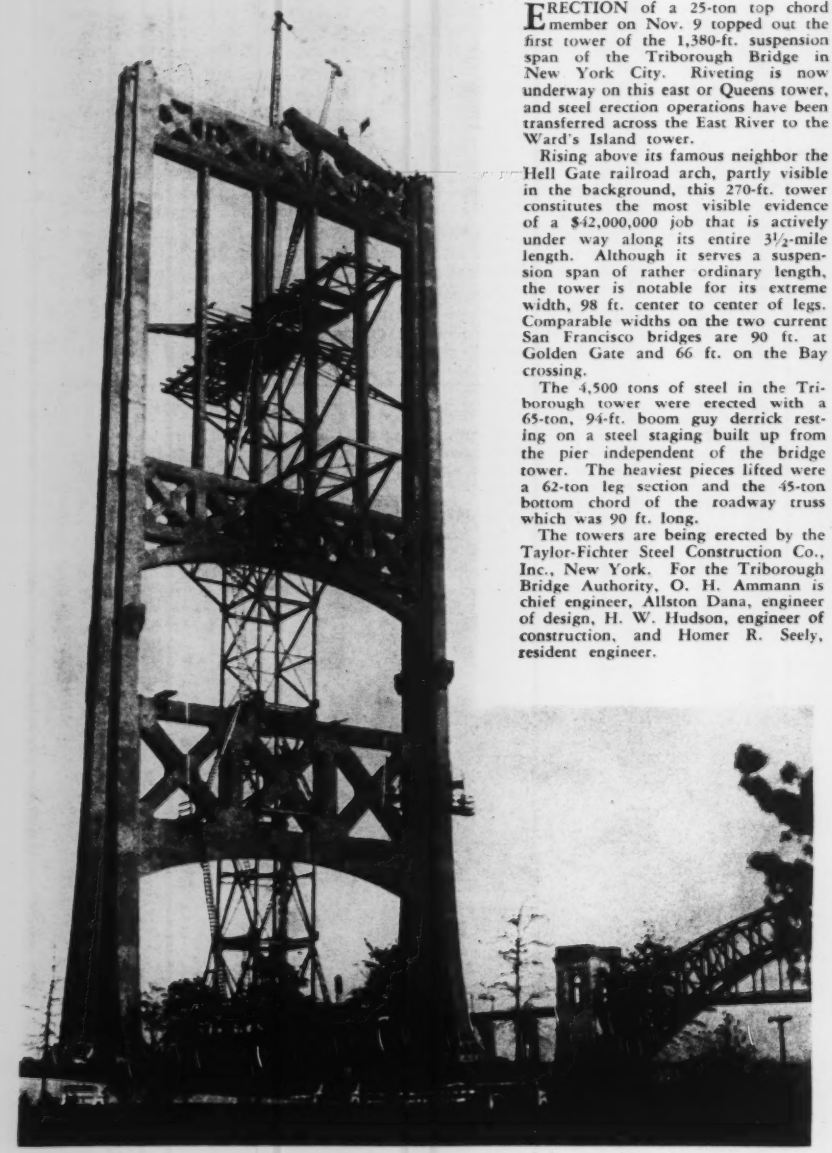
New York Completes Plans for Sewage Plant at Coney Island

Plans for the second unit of New York's program of building sewage treatment plants, a 35 m.g.d. plant at Coney Island, have been submitted for approval to Arthur S. Tuttle, PWA engineer for New York state. The PWA has approved a loan and grant for the project and the bond contract is now in process of negotiation.

The plant is estimated to cost $1,866,000. It will comprise sedimentation tanks equipped for mechanical removal of sludge and sludge-digestion tanks with provision for collection and utilization of the sludge gas. Chemical coagulants, ferric sulphate and lime, will be employed to aid sedimentation during the four summer months. Chlorination will also be practiced during that season to give an added degree of protection to the adjacent beaches. The effluent will be discharged through a 1½-mile long outfall into Rockaway Inlet. The gas collected from the digesting sludge will be used as fuel for gas engines to provide power for the pumping station to be operated in connection with the treatment plant. A connection to the city gas mains will provide supplementary power service. The digested sludge will be dewatered by mechanical filters. An alternate design of the sedimentation tanks provides for the installation of mechanical filters for the effluent.

Preparation is now being made by the Department of Sanitation to begin design of two more units of the sewage treatment program, a plant at College Point, to treat the sewage from that part of the borough of Queens east of the Flushing River, and a plant at Jamaica. The Jamaica plant will be larger than the one to be built at Coney Island.

SETTING LAST MEMBER IN QUEENS TOWER OF TRIBOROUGH BRIDGE IN NEW YORK CITY



ERECTION of a 25-ton top chord member on Nov. 9 topped out the first tower of the 1,380-ft. suspension span of the Triborough Bridge in New York City. Riveting is now underway on this east or Queens tower, and steel erection operations have been transferred across the East River to the Ward's Island tower.

Rising above its famous neighbor the Hell Gate railroad arch, partly visible in the background, this 270-ft. tower constitutes the most visible evidence of a $42,000,000 job that is actively under way along its entire 3½-mile length. Although it serves a suspension span of rather ordinary length, the tower is notable for its extreme width, 98 ft. center to center of legs. Comparable widths on the two current San Francisco bridges are 90 ft. at Golden Gate and 66 ft. on the Bay crossing.

The 4,500 tons of steel in the Triborough tower were erected with a 65-ton, 94-ft. boom guy derrick resting on a steel staging built up from the pier independent of the bridge tower. The heaviest pieces lifted were a 62-ton leg section and the 45-ton bottom chord of the roadway truss which was 90 ft. long.

The towers are being erected by the Taylor-Fichter Steel Construction Co., Inc., New York. For the Triborough Bridge Authority, O. H. Ammann is chief engineer, Allston Dana, engineer of design, H. W. Hudson, engineer of construction, and Homer R. Seely, resident engineer.

General Contractors Protest Renewal of Masonry Code Dues

A VIGOROUS ATTACK, led by the Divisional Code Authority for General Contractors and the Associated General Contractors against the granting of the application of the Mason Contractors Divisional Code Authority for a termination of the duplicate code assessment exemption (Administrative Order X-36) was made at hearings before NRA Acting Division Administrator Walter G. Hooke, Nov. 15, at Washington. Contending that masonry work is a recognized function of the general contractor and that general contractors performing masonry work with their own forces outnumber mason contractors ten to one in numbers and five to one in volume, the authority for general contractors insisted that members of the industry should not be forced to contribute to the code administration expense of the minority group which confines its activities to masonry alone.

Both the general contractor's authority and the A.G.C. challenged the mason unit's right to assess general contractors not only on the grounds of the latter's lack of representation along functional lines, but also because the mason contractors code clearly defines the scope of its application to those confining themselves strictly to masonry.

A. E. Horst, chairman of the general contractors authority, outlined the efforts that the authority had made to have the definition of the mason contractors code properly coordinated with that of the general contractors, and its activities in this regard "since the inception of the controversy arising out of the infringement of the Code for Mason Contractors into the province of the Code for General Contractors." He insisted that granting of the termination of the exemption would be inequitable and unjust to general contractors and would impede and impair the proper administration of Chapter II of the Construction Code.

Burt L. Knowles, of the governing board of the A.G.C., stated that facts and figures are in the hands of NRA to demonstrate that the sponsors of the Mason Contractors Code are not representative of organizations other than those special contractors whose contracts are specifically for executing masonry work.

The application for the termination was defended principally by David C. Butcher, president of the Mason Contractors Association, and J. D. Otley, of the executive committee of the Mason Contractors Code Authority. Mr. Butcher declared that the effect of Administrative Order X-36 is to destroy the sub-contractor, and that failure to terminate the exemption provided therein will leave Chapter VIII (Mason Contractors' Chapter) hopelessly bankrupt, with the possibility that the debts already incurred will have to be turned over to the NRA for adjustment.

Administrator Hooke granted permission to all parties to the controversy to file additional briefs of rebuttal and statistical data, with the understanding that they should be presented not later than Nov. 19, so that an early decision may be reached in regard to the application.

Collapse of Breasting Causes Tunnel Cave-in On Sewer Project in Chicago

COLLAPSE of breasting at the face of the south heading of the large tunnel, being driven under compressed air for the West Side Intercepting Sewer at Jefferson St. and Canalport Ave., Chicago, on Nov. 12 caused a cave-in, and subsequent flooding of the bore due to a broken water main. Cracking of the breastboards prior to complete failure gave ample warning to the crew, permitting all to escape safely through the air lock, 900 ft. away. Little damage was done to the tunnel itself, but in addition to the breaking of the 16-in. water main, a section of street 50 ft. long and 20 ft. wide caved in, carrying a 12-in. sewer line, a 4-in. gas main and a concrete-encased power conduit into the hole.

The tunnel, 17x17-ft. horseshoe section inside of a 17 to 28-in. reinforced concrete lining, is being driven through an area of varying geological structure with irregular deposits of sand and loam. At the point of failure, the bottom of the invert is 36 ft. below street grade, with groundwater level at the top of the tunnel. The top 10 ft. of overlying material is fill, placed some time ago to raise the street grade.

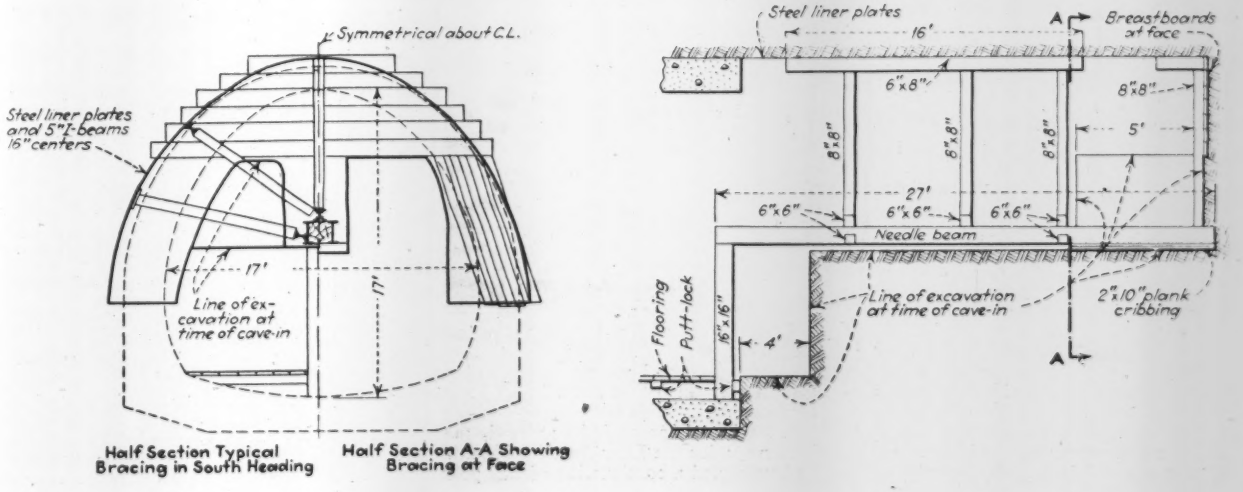
Tunneling methods

The tunnel is being driven under compressed air (about 8 lb.) by a system involving steel plate lining with temporary needle beam and jack strut supports. The steel plates, 16x37 in., are reinforced with 5-in. I-beam ribs bolted between rings of plates. The tunneling procedure is to start at the top center with a drift just deep enough to admit a new ring of plates, carry this drift down each side until a bench is reached, where the plates are blocked up. The tunnel is advanced 24 ft. in this manner before the interior prism is removed. After a 24-ft. section of steel plate lining has been placed, a central slot is cut down from the top to bench level, where a needle beam is placed. As the interior prism is excavated, three sets of radial jack braces are carried from the needle to the lining. The face of the heading is kept breasted with planks wedged in front of the steel lining and braced from the inside. The accompanying sketches show the bracing system. Permanent concrete lining is carried forward in 24-ft. sections as fast as the tunnel is excavated.

At the time of the accident the pilot section 24 ft. long had been mined out, the needle beam placed, the steel lining completed and braced with the radial struts. The face was breasted with 3x12-in. planks. One of the planks started to crack, and examination by the heading foreman showed that the whole face was slowly giving way. He immediately ordered all men out, and in ten minutes the failure occurred.

The sewer is part of a PWA project for the Sanitary District of Chicago, being carried out under the direction of Phillip Harrington, chief engineer of the district. District and PWA engineers expressed the opinion that the contractor, the Ready Coal and Construction Co. of Chicago, had exercised all reasonable precautions and was proceeding with the work in entire accordance with the terms and conditions of the contract.

TUNNELING METHOD and bracing used on West Side Intercepting Sewer tunnel in Chicago. Cave-in resulted from failure of breasting at face.



Massachusetts Starts Program of $3,350,474 Highway Work

During the next six months the Massachusetts Department of Public Works will build 45.8 miles of highway from Federal funds at a cost of $3,350,474, according to an announcement made this week. Among the larger projects are: a grade crossing separation at Huntington Avenue and Jamaicaway $290,000, highway extension, 1.6 miles, on Boston-Dedham route $385,000, elimination of Beaver Brook grade crossing of Boston & Maine Railroad, Waltham, $215,000, rebuilding 6.9 miles of highway between Dracut, Methuen and Lowell $523,874, reconstruction of 4.5 miles of highway in Montague $250,000, 1.5 miles of highway connecting Plymouth highway with the Sagamore bridge in Bourne, $125,000. While most of the work will be started next spring, part will get under way this fall.

Restricting Pump Specification Causes Delay in Contract Award

A specification for pumping plant equipment drawn so strictly, according to report, that only one manufacturer's equipment could be used, resulted in a temporary delay in the award of the Cahokia Creek diversion canal of the East Side Levee and Sanitary District, near St. Louis. The low bidder was G. Locke Tarlton, St. Louis, at a figure of $2,259,933. The PWA had allotted the district a loan and grant of $2,360,000 for this project.

Rival pump manufacturers, according to reports, protested to C. M. Osborn, state PWA engineer, who notified the trustees of the district that the award of contract would not be approved unless the pump specifications were revised and bids readvertised. After tentatively accepting the Tarlton bid, the levee district board adopted a resolution setting forth its advertisement for competitive bidding and ordered this resolution and copies of bids sent to state PWA engineer.

Subsequently an agreement was reached between the levee district and the PWA officials in Washington which will result in approving the award to the low bidder provided he will consent to a revision in the specifications for the pumping equipment. As the result of this compromise, the general construction work on the canal may be started at once, taking advantage of the work which can be done before the usual spring rise in the Mississippi River.

Course in City Planning Offered at Cornell University

Cornell University has instituted a new course in city planning open to all students of the university. A grant from the Carnegie Corporation of New York City will finance the project for a period of three years. The university board has appointed Gilmore D. Clarke, New York, professor of regional planning to supervise the new enterprise. The course will be in the nature of an experiment for, unlike other colleges that have established city planning courses, Cornell will attempt to develop an understanding of the subject among students whose main interest lies outside the technical planning field. Mr. Clarke will assume his new duties in February.

Highway Officials Meeting at Santa Fe

(Continued from p. 668)

railroad participation in the cost of separation are effective "stop orders" on such a program, and urged the amendment of statutes to permit grade-separation construction at 100 per cent public expense if necessary. He stressed the need of pedestrian foot paths, especially near the cities. Mr. MacDonald also urged the need of traffic studies to determine the roads that would be logical additions to the federal aid systems, and cited the Indiana study as especially valuable.

Transport coordination

The relation of highway transport to other forms was presented from various angles. Paul D. Myers, substituting for J. Carroll Cone of the department of aeronautics, showed the relation of highways to aeronautics, and how vitally an adequate development of airways is dependent on proper coordination with highways.

Col. A. B. Barbour of the Chamber of Commerce of the United States pointed out the confusion in highway transport arising from a diversity of regulations. There is need to coordinate the thinking of men dealing with various phases of transport, also to secure uniformity in different states. He did not suggest federal regulation, on account of the impossibility of providing the policing that would be necessary under such regulation. The need is for uniformity in state regulation, the function of the federal government is to assist in coordinating the states.

Col. Barbour pointed out the lack of fundamental data necessary for the formulation of proper regulations and the need of research to provide such data. He dwelt on the terrific loss of life and the property damage through automobile accidents; these are increasing faster than registrations. This increase is going on at a time when both vehicle and road are being greatly improved. He cited the decrease in accidents to children and the decrease in accidents in which commercial drivers are concerned, both of which have resulted from the adoption of safety practices, as proof of the feasibility of reducing accidents through such means. He urged the universal adoption of the Uniform Motor Vehicle Code of the U. S. Chamber of Commerce, and related traffic measures. "We know what to do about traffic from the safety standpoint," said Colonel Barbour, "what we need on the part of public authorities is understanding, and a will to use what we know."

O. W. Merrell, Ohio Highway Director, described the work done in Ohio in the radio apprehension of criminals. He visioned an arrangement by which radio methods would become universal and governmental boundaries cease to be obstacles in the way of public officers in pursuit of fugitives. L. E. Wallace, superintendent, Motor Vehicle Department of Iowa, spoke on the need of closer relationship between the association and the American Motor Vehicle Association. He cited as the objectives of motor vehicle operation (1) the free movement of traffic over highways under proper construction, maintenance and supervision, (2) the safety of persons and property on the highways, (3) the payment of fair taxes by operators. To secure these objectives, effective motor vehicle departments are needed in every state.

Stuart C. Hawley, director, National Road Reports, New York, spoke on traffic control and safety, from the standpoint of the tourist. He cited the multiplicity of warning signs, of which many are useless and tend to bring them all into disrepute, and especially the practice of routing tourists through towns without making proper provision for parking, etc. He urged the need for uniform driving laws, a 45-mile speed limit, with strict regulation, and the need of highway departments selling themselves to the public. "The sooner they assume direction and enforce regulations to make driving more pleasant, the better it will be for them."

Roadside planning

The nearest approach to something new and novel was a paper on "Roadside Planning and Development" by M. W. Torkelson, Wisconsin Regional Planning Committee. Mr. Torkelson asserted that a road is not properly constructed unless it is beautiful as well as useful and safe; that proper design will provide for the three qualities named. It is essential to control the roadside as well as the road. Expenditures for improvement within the right of way are largely nullified if eyesores are permitted to remain just over the fence. He urged a revision in grading practices which, he contended, will provide a better, safer and more beautiful road without appreciable increased expense.

A dominant note, sounded by many was that highway construction is the form of public works which will most rapidly put men to work, and return full value for the dollar spent. Mr. MacDonald said, "Employment remains the great national problem. Highway work offers direct job relief and requires industrial production." Fully as insistent was the protest against the diversion of motor-vehicle revenues (license fees and gas tax) to purposes other than highways. National legislation designed to prevent further diversion by states was commended, and further legislation recommended in the report of the resolutions committee.

Resolutions adopted

The resolutions and recommendations of the committee, which were adopted without amendment, were to the following effect:

1. Expressed appreciation of federal-aid grants. Pledged allegiance and support in securing proper returns for expenditures and cooperation in putting under early construction any and all money that may be made available.

2. Approved the three-year program set up by the 73rd Congress as providing the continuity needed for stability or organization.

3. Approved the anti-diversion feature of the present federal-aid law. Recommended that future legislation give states opportunity to repeal present diversions, failing in which after a reasonable period, federal aid to be withdrawn.

4. Approved action of executive committee in consolidation of United States route numbers and adding to the national system only important roads in unoccupied territory.

5. Approved appropriations already made in surveys for the Inter-American highway and supported a continuation of this policy.

6. Recommended the appointment of a committee to cooperate with a similar committee of the American Motor Vehicle Association in bringing about coordination of the activities of the two associations.

7. Approved the revised manual of the Conference on Street and Highway Safety and recommended installation of the new type signs as rapidly as possible.

8. Urged state highway departments to make adequate surveys for use in deciding on extensions to the federal-aid system.

9. Favored a railroad grade separation program with federal funds.

10. Assured the federal government of cooperation in a program of secondary-road construction.

11. Recommended that contractors producing sand and gravel for specific projects with portable plants (roadside pits) should not be under NRA codes but under regulations of the Bureau of Public Roads.

12. Recommended the 40-hour week, and the right of contractors to secure skilled and semi-skilled labor anywhere in the state.

13. Recommended a study to find methods of taxing diesel-driven equipment on a basis comparable with other motor vehicles.

14. Recommended discontinuance of movable bridges or requirement of excessive clearances over streams not navigable in fact or only slightly navigable.

Louisiana Highway Department Undergoes Reorganization

Harry B. Henderlite, who served as chief engineer of the Louisiana Highway Commission for several periods since the inauguration of the major highway construction program of that state in 1928, has been re-named state highway engineer to succeed W. H. Norckauer. The change takes effect immediately. Mr. Norckauer will resume his position as federal aid engineer, which he relinquished more than a year ago to succeed Mr. Henderlite. W. H. Postell, who has been serving as federal aid engineer, will resume his previous duties as assistant federal aid engineer.

The reorganization in these principal engineering positions, according to A. P. Tugwell, chairman, Louisiana Highway Commission, have been made in preparation for the beginning of a large scale highway construction program. The commission hopes to sell $12,500,000 of authorized bonds. If these bonds are sold, $7,000,000 will be available for tertiary gravel roads, $3,000,000 will be available for closing gaps in the principal state highway routes, and $2,500,000 will be used for the Mississippi River bridge at Baton Rouge.

SOCIETY CALENDAR

HIGHWAY RESEARCH BOARD, annual meeting, Washington, D. C., Dec. 6-7.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, Jan. 16-18.

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION, annual meeting, Washington, D. C., Jan. 10.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Indianapolis, Ind., Feb. 7-8.

AMERICAN ROAD BUILDERS, annual convention, Washington, D. C., Jan. 22-25.

CANADIAN CONSTRUCTION ASSOCIATION, annual convention, Montreal, Que., Jan. 29-31.

Obituary

VICTOR H. KRIEGSHABER, founder and president of the engineering firm of V. H. Kriegshaber & Sons, Inc., Atlanta, Ga., died in that city Nov. 12 at the age of 75. He received his technical education at the University of Darmstadt, Germany. He was in the engineering department of the city of Louisville and the construction department of the Louisville & Nashville Railway before organizing his own engineering company.

RALPH M. DRAVO, president of the Dravo Contracting Co., and chairman of the board of the Dravo Corporation, died at his home in Pittsburgh Nov. 11 at the age of 66. His death occurred less than a year after his brother and business associate, F. R. Dravo, was killed in a railroad crash. The two Dravo brothers founded F. R. Dravo & Co., which subsequently grew into the present contracting company. Mr. Ralph Dravo graduated from Lehigh University in 1889 and following a brief interval with the Illinois Steel Co. and the Carnegie Steel Co., joined his brother in the contracting business. In addition to serving as director on several industrial and material companies, he was on the board of directors of Bridge Builders, Inc., the contracting organization which is constructing the west channel piers of the San Francisco Bay bridge.

PAUL A. SEUROT, widely known engineer in the Northeastern States and Canada and engineer of rapid transit for the Montreal Tramways Co., died at Montreal Nov. 18. He was 65 years old. Born in Paris and graduating from a French technical school, Mr. Seurot came to the United States at the age of 21. He worked on several railroad developments, including the Long Island Railroad, and the preliminary designs and studies for the proposed Brooklyn rapid transit system. From 1901 to 1906 he served as engineer on the Pennsylvania tunnels under the East River and the Hudson River. Later he spent several years in England and France making studies of rapid transit systems and served as engineer in charge of the Concorde tunnel under the Seine. He became a permanent resident of Canada in 1911.

SIR ROBERT MCALPINE, head of one of the most widely known firms of English contractors, died recently in England at the age of 87. He was born in Scotland and began work as a bricklayer, entering business for himself at the age of 20 by taking small masonry contracts. Later he enlarged the business to include engineering contracting and the firm of Sir Robert McAlpine & Sons grew to be one of the largest in England; the contracts executed by the firm during the last 60 years are estimated to exceed one-half billion dollars. He was one of the early experimenters in the use of reinforced concrete as a building material and was associated with the building of the first subway in Glasgow in 1890. His organization built many of the more important British factory structures, including many munitions plants.

CONSTRUCTION STATISTICS OF THE WEEK

ENGINEERING construction contract awards at $37,407,000 make this week the fourth highest this year. Heavy federal awards, $17,189,000, continued state and municipal awards, $16,991,000, and private contracts at $3,227,000 make up this total. Cumulative engineering construction awards to date are 23 per cent ahead of last year.

The high volume is in public buildings $9,296,000; streets and roads are $8,654,000 and earthwork, irrigation, drainage and waterways $9,728,000. Bridges at $1,508,000 are ahead of last week but waterworks at $561,000 and sewerage at $976,000 are considerably below. Industrial building awards at $1,384,000 are only slightly below a week ago but commercial buildings at $628,000 show a considerable drop.

The larger contracts for the week include, Post Office, New York, N. Y., $5,597,000; highways awards by Connecticut $887,000, by Missouri $1,510,000, by Kansas $959,000 and by Pennsylvania $958,000; spillway for Ft. Peck Dam, Mont. $7,133,000; levee work along shore Lake Okeechobee, Fla., $2,147,000; and equipment for the New York subway system $2,688,000.

Although municipal bond sales for the week totalled $4,225,000, the excess of federal PWA reductions and rescissions over new allotments, turns the new capital curve down.

CONTRACTS

(Thousands of Dollars)

	Weekly Nov. 1933	Average Prev. 4 Weeks	Week Nov. 22 1934
Federal Government	$10,554	$3,633	$17,189
State and municipal	14,238	18,421	16,991
Total public	$24,792	$22,054	$34,180
Total private	4,739	3,798	3,227
Week's total	$29,529	$25,852	$37,407

Cumulative to date:
1933.....$941,888 1934.....$1,161,220

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

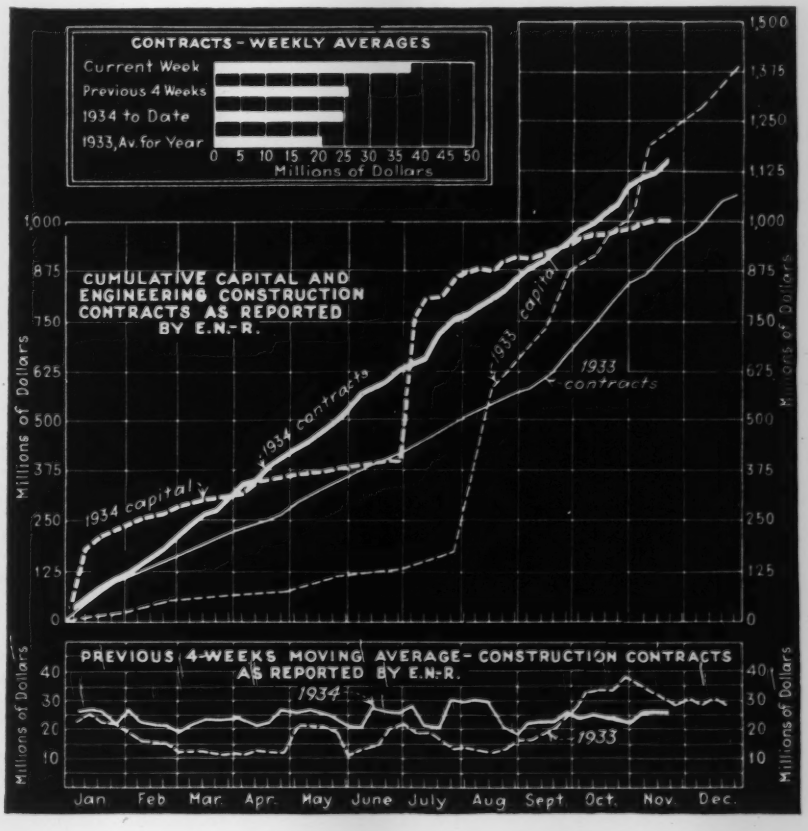
1934	Week Nov. 22	Cumulative
State and municipal	$4,225	$296,414
PWA allotments, S&M	—4,684	608,397
RFC loans, S&M	....	25,463
Corporate issues	....	18,256
PWA allotments, private	....	57,022
Total, Non-Federal	—$459	$1,005,552
PWA allotments, Federal Constr.	165	193,690
Total new capital	—$294	$1,199,242

Cumulative to date:
1933.....$1,235,186 1934.....$1,005,552

Note: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

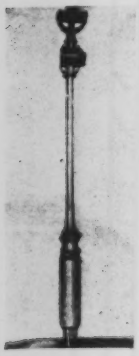
E.N.-R.- Cost	1913 = 100	1926 = 100	E.N.-R.- Volume	1913 = 100	1926 = 100
Nov., 1934	201.36	96.76	Oct., 1934	98	43
Oct., 1934	200.86	96.55	Sept., 1934	101	44
Nov., 1933	190.14	91.40	Oct., 1933	162	71
1933 (Av.)	170.18	81.80	1933 (Av.)	102	45
1932 (Av.)	156.97	75.45	1932 (Av.)	127	56
1931 (Av.)	181.35	87.17	1931 (Av.)	220	96.5



Construction Equipment and Materials

Internal Vibrator for Concrete Has Small Diameter

A new four-inch internal vibrator for concrete has been announced by the Electric Tamper & Equipment Co., Ludington, Mich. To keep the diameter down to a minimum and at the same time to produce a sufficient amount of power for the machine the manufacturer states that he has used a special design of electric motor.



4-in. vibrator

The machine can be furnished with any length of handle desired. It consists of an electric motor operating on 110 volts, three phase, 60 cycles. The unbalanced weights, of which there are two, are a part of the revolving element of the motor, the whole being carried upon four ball bearings. The machine weighs 55 lb. The maker states that the motor is constructed in such a manner that it can easily be taken apart for cleaning and lubrication.

The machine has been designed especially for use in thin sections of concrete.

Mobile Drill Rig

A new light, mobile drill rig, designated the Rock Master, has been announced by the Worthington Pump & Machinery Corporation, Harrison, N. J. It is readily adapted for down-hole drilling, line drilling, hillside drilling, breast-hole drilling, side-hole drilling and snake-hole drilling. The manufacturer states that it is readily moved from place to place. It can be used extensively for deep hole drilling (up to 20 ft.) supplemented by hand-held drills for boulder popping.

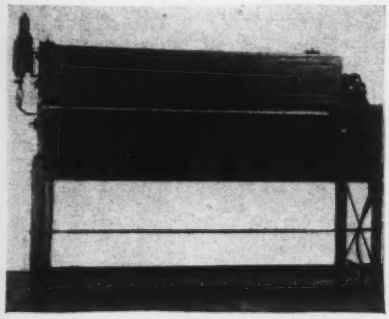
Worthington's new Rock Master

The machine is recommended for holes up to 20 ft. in depth. It is equipped with a hole spotting device and can be furnished with feeds to accommodate a 3 ft., 4 ft. or a 6 ft. maximum steel change.

Electric Developing Machine for Ozalid Prints

The Ozalid Corporation, New York, N. Y., has announced a new electric developing machine for the reproduction of tracings on Ozalid paper. A dry developing process is employed which makes positive prints in one operation, and gives a line print with a white background surface. The paper is developed through the medium of the vapor of ammonia.

A gas-tight container of the machine is equipped with a perforated top over which passes an endless rubber belt driven by an electric motor. Two electric heaters maintain a temperature of from 180 deg. to 200 deg. F. inside the tank. The ammonia is introduced by a drip feed, and the heat causes immediate evaporation. Ozalid prints, after exposure, are set into the machine and carried over the perforated top of the tank by the belt and brought into contact with the ammonia fumes.



Ozalid print developing machine

New Equipment in Brief

Crane and Shovel. The Ohio Power Shovel Co., Lima, Ohio, has announced a new two-yard heavy duty shovel, and 35-ton crane. The machine is designated as type 801. It can be furnished with gasoline, diesel or electric power.

Snow-Plough Tractor. Linn Manufacturing Co., Morris, N. Y., has announced a new high-speed heavy duty model of their flexible traction type truck tractor, known as Model 6H-33 for snow plough service. The top speed is 12 m.p.h.

Excavating Machine. A new excavating machine known as the Victor Special, having a capacity of 1½ cu.yd., has been announced by the Osgood Co., Marion, Ohio. The machine is adapted to shovel, crane, dragline, back hoe and skimmer scoop work. All operating machinery lies well back of the center line of rotation which, according to the manufacturer, gives the machine the best possible balance and allows it to lift its required load with the use of the least amount of counterweight. The machine is available with gasoline engine, diesel engine, or electric motor drive. Transmission from the power unit to the machinery propeller is by means of a heavy silent chain.

Welding Electrode. A new heavy-coated arc welding electrode, designated as G-E Type W-23, for the production of high-speed welds in a flat position has been announced by the General Electric Co., Schenectady, N. Y. The electrodes are suitable for either manual or automatic arc welding.

Rotary Pump. A high speed rotary displacement pump has been announced by the De Laval Steam Turbine Co., Trenton, N. J. The pump is known as the De Laval-IMO pump. It is driven at 1,675 r.p.m. by a 60 hp. gasoline engine and delivers 60 gal. per min. against 495 lb. per sq.in. pressure, with a suction lift of 14 in. of mercury. The pump itself weights 398 lb.

Warcolite. A repair and resurfacing mixture for general street and road work is announced by Warren Bros. Co., Boston, Mass. The maker states that it is workable in all temperatures conducive to repair and resurfacing work. The material can be open to traffic as soon as the pavement is compacted.

Business Notes

THE AMERICAN ROLLING MILLS CO., Middletown, Ohio, has established a new sales office in Atlanta, Ga. The address will be Citizens and Southern National Bank Bldg.

SHEPARD NILES CRANE AND HOIST CORPORATION has concentrated all its manufacturing divisions at Montour Falls, N. Y. The Niles plant in Philadelphia has been closed and its equipment moved to Montour Falls.

THE AMERICAN HOIST & DERRICK COMPANY, St. Paul, Minn., announces the resignation of Frank J. Johnson as president. Frederic Crosby succeeds Mr. Johnson.

LINK-BELT COMPANY, Chicago, Ill., announces the purchase of the physical assets of the Bailey-Burrus Manufacturing Co., Atlanta, Ga. The new combined operations will be headed by I. H. Barbee.

Special Sections to Be Rolled for Bearing Pile Service

As a result of the growing use of structural steel shapes as bearing piles, the Carnegie Steel Co., Pittsburgh, Pa., has developed a series of specially designed CB sections for this type of service. In general, the special sections, of which there are nine, have a high radius of gyration and uniform flange and web thicknesses. The latter insures uniform life for all parts of the section under normal conditions of exposure.

Four of the special sections—8x8 in.-36 lb., 10x10 in.-42 lb., 12x12 in.-53 lb., and 14x14½ in.-73 lb.—have a minimum metal thickness of $\frac{7}{16}$ in. They are planned for use under nearly all cases of fresh water or inland exposure.

The remaining five special sections are thicker and heavier. The minimum thicknesses for each size and weight are as follows: 10x10 in.-57 lb.-$\frac{7}{8}$ in.; 12x12 in.-74 lb.-$\frac{3}{4}$ in.; 14x14½ in.-89 lb.-$\frac{5}{8}$ in.; 14x16 in.-102 lb.-$\frac{11}{16}$ in.; and 14x16 in.-117 lb.-$\frac{13}{16}$ in. These sections are especially adaptable for use where salt water or seaboard exposure is encountered, where heavy loads must be carried on individual piles, where hard driving is encountered or where the pile has to act as a free standing column of considerable height.

These new special sections will be offered at the regular structural steel base price plus the usual CB section extra.

CONSTRUCTION REPORTS

WATERWORKS

PROPOSED WORK

Calif., San Diego—City defeated $350,000 bonds, to be used with other funds to construct pipe line from El Capitan Dam to lakeside, also $96,000 for repairing and strengthening Hodges Dam. Noted Oct. 4.

Ill., Evanston—City voted $250,000, for 1 m.g. water storage tank, 16 in. or larger water-main extensions in various streets. Alvord, Burdick & Howson, 20 North Wacker Dr., Chicago, engrs. P.W.A. project. Noted Oct. 4.

Ia., Creston—Election Dec. 14, on proposal to purchase Taxpayers Municipal Water Plant for $185,000 and spend $40,000 for improving same. Noted Nov. 22.

Ky., Wingo—Town voted bonds for waterworks system. J. S. Watkins, 610 Citizens Bank Bldg., Lexington, engr. G. B. Henson, city clk. P.W.A. project. Noted Nov. 8.

Kan., Yates Center—City and Missouri Pacific R.R. Co., plan concrete reservoir and additional pumping equipment, 2 mi. 6 in. pipe line. City to build reservoir, etc. and railroad to build pipe line. $30,000. Wilson Eng. Co., Salina, engrs.

La., Jackson—City, J. M. Johnson, mayor, plans waterworks system. F. P. Joseph, Glenmora, engr. P.W.A. allotted $41,000 loan and grant.

La., St. Joseph—City, P. Watson, mayor, plans water filtration plant. P.W.A. allotted $6,700 loan and grant. Louisiana Power & Light Co., St. Joseph, engrs. Noted Dec. 28.

Mass., Winchendon—Town, preliminary surveys extension to water supply system. Special commission appointed. R. E. Smith, chn. Fay, Spofford & Thorndike, 44 School St., Boston, engrs. Noted Mar. 22.

Mo., Miller—City voted $27,000, waterworks and distribution system, $35,000 loan and grant allotted by P.W.A. Ozark Engr. Co., Court House, Springfield, engrs. Noted July 15.

Mo., Oak Grove—City voted $40,000 new waterworks, incl. wells, 16 in. mains, reservoir. Shockley Eng Co., 800 Graphic Arts Bldg., Kansas City, engr. Noted Nov. 2.

Mo., Perry—City voted $43,000 for waterworks system. W. B. Rollins & Co., 339 Railway Exch. Bldg., Kansas City, engrs. Noted July 26.

Nebraska—See "Public Buildings."

N. Y., Amsterdam—Municipality plans water filtration plant. $83,000 grant allotted by P.W.A. Nicholas S. Hill, Jr., 112 East 19th St., New York, engr. Noted Apr. 19.

N. Y., Coney Island (sta. Brooklyn)—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., New York, plans pumping station, $503,000 P.W.A. funds allotted. M. D. Metcalfe, 1310 Bedford Ave., Brooklyn, archt. J. Goodman, Municipal Bldg., New York, ch. engr.

N. Y., Saratoga Springs—Municipality bids early in December, filter plant and pumping station. N. S. Hill, 112 East 19th St., New York, engr.

O., Middlepoint—Village, D. C. Wohler, clk., making plans waterworks and distribution system, elevated tank, 1 m.g. capacity. $36,000. C. J. Simon, Van Wert, engr. P.W.A. project. Noted Sept. 20.

O., Pemberville — Village, S. R. Williams, mayor, making plans waterworks system, $75,000. Bond issue voted. A. H. Smith & Niles Co., 1723 Woodruff Ave., Toledo, engrs. P.W.A. project.

O., Perrysville—Village making plans waterworks system. $23,000. M. D. Shaffer, 509 Richland Trust Bldg., Mansfield, engr. Bond agreement approved. P.W.A. project. Noted Dec. 14.

Okla., Sapulpa—City made preliminary plans new impounding reservoir, for water supply, $75,000. C. Dietz, Sapulpa, engr.

Tex., Littlefield — City, c/o W. G. Street, mayor, bids after Nov. 31, waterworks improvement, consisting of 1 story, concrete, brick plant building, 55 hp. pump with 110 hp. oil engine, 9,700 ft. of 6,000 v. transmission lines, 350 g.p.m. motor-driven turbine type centrifugal well pump, 9,700 ft. D class 150 8 in. c.i. supply main, 2,000 ft. 8 in. Class H distribution lines. $48,000. H. N. Roberts, 2415 20th St., Lubbock, engr. Noted Sept. 13.

Tex., Pecos—City, B. A. Toliver, bids latter part of month, waterworks improvements, incl. 89,500 ft. 4- to 10-in. c.i. pipe, three 300 g.p. deep well turbines, boosters, motors, transmission lines, etc. $300,000. H. R. F. Helland, Frost Bldg., San Antonio, engr. G. B. Warne, Pecos, engr. Noted Oct. 25.

Tex., Stockdale—City making plans waterworks system. $34,000. P.W.A. project. H. N. Tulley, Seguin, engr. Fargo Engr. Co., Seguin, consult. engrs. Noted Nov. 8.

Wash., Centralia—Election Nov. 28, $46,000, for replacing 14,000 ft. gravity pipe line of city's water system. $80,000 of which amount $15,000 has been granted by the state and $19,000 is to come from federal government if bond issue carries. **P.W.A.**

Que., Montreal—City Executive Com. voted $28,161, for water pipe construction.

BIDS ASKED

Calif., Los Angeles—Dec. 4, by Bd. Directors Metropolitan Water Dist., 306 West 3rd St., F. E. Weymouth, engr., constructing aqueduct, cut and cover siphons, outlet channel and appurtenant works. Spec. 82, Schedules 20 K, 21, 22 and 23, all siphons to be monolithic. Noted Nov. 15.

Ill., Atwood—Dec. 10, by Village, G. W. Robertson, mayor, waterworks, $50,000. P.W.A. project. Warren & Van Praag, Inc., Milliken Bldg., Decatur, engr.

Ill., Warrensburg—Dec. 14, by Bd. Trustees, A. H. Horn, pres., waterworks, $36,000. P.W.A. project. Warren & Van Praag, Inc., Millikin Bldg., Decatur, engrs.

Ill., Zion—Dec. 5, by City, E. E. Harwood, mayor, waterworks, $17,000. P.W.A. project. J. J. Craig, city engr.

Ind., Huntington — City taking bids new watermains from pumping station to factory district. Mrs. R. Sheets, clk.

Ia., Franklinton—Dec. 5, by City Council, drilling artesian well to supply drinking water. B. Bures, clk. Election Dec. 3 for same. Noted Nov. 5.

Mass., Townsend—Nov. 27, by Bd. Water Comm., furnishing, installing pumps and equipment. P.W.A. Docket 2384. Whitman & Howard, 89 Broad St., Boston, engrs.

Mo., Oak Grove—City bids about Dec. 1, materials for three wells, 29,050 lin.ft. 2- to 4-in. c.i. mains; 21 fire hydrants, elevated steel tank and pumps. $44,000 voted. P.W.A. project. Black & Veatch, 700 Mutual Bldg., Kansas City, engrs. Noted Nov. 22.

N. Y., Hamburg—Nov. 30, at office Village Clerk, 46 Main St., waterworks. $51,621. P.W.A. project. Noted Aug. 23.

N. C., Hickory—Nov. 27, by Mayor and City Council, M. H. Yount, mayor, waterworks improvements, constructing complete water purification plant with 1½ m.g.p.d. capacity, incl. building, subsidence and mixing basins, ½ m.g. filtered water reservoir, filter and pumping equipment, piping, plumbing, heating, etc. $151,000. W. C. Olsen, 5 Exchange Pl., Raleigh, engr. Noted July 19.

O., Coshocton—Dec. 5, by V. Johnson, safety dir., replacing and extending waterworks lines. $164,000. L. C. Lamb, city engr.

Pa., Conneautville—See "Contracts Awarded."

Pa., Phila.—Nov. 27, by City, furnishing, laying c.i. pipe line. F. H. Caven, City Hall Annex, dir. P. Wks.

Pa., Reading—Dec. 5, by City Clerk, City Hall, waterworks improvements, incl. Contr. 67, road improvements, grading, paving 4 mi. by, incl. paving of bridge over Spillway of Ontelaunee Dam, Maiden Creek and Ontelaunee Twps.; Contr. 68, constructing concrete encased structural steel girder bridge, of thirty-three ft. span over tracks of S. & L. Branch, of the Reading Co.; Contr. 69, furnishing, placing rip rap along right-of-way of S. & L. branch of Reading Co.; Contr. 70, filtered water piping, incl. furnishing, installing 30 in. and 10 in. c.i. filtered water piping, complete with fittings, valves, orifice plate and recording device between Maiden Creek pumping station and mechanical filtration plant, etc. **Plans and specifications on file in Searchlight Dept.**

S. C., Pendleton—Nov. 27, by Town, Town Clerk, constructing water supply and distribution system, incl. 2,130 ft. 8 in. and 14,000 ft. 6 in. c.i. pipe, 13,900 ft. 1¼- to 2-in. galvanized pipe, 46 gate valves, 32 fire hydrants, pumping station and wells, 75,000 gal. elevated tank on 100 ft. tower. $50,000. Harwood Beebe Co., Spartanburg, engrs. Noted July 26.

Tex., Avery—Dec. 7, by City, c/o W. M. Bryan, waterworks improvements, incl. storage and distribution system, well and elevated tank. $21,000. P.W.A. project. D. C. Dalmsley, Thomas Bldg., engr. Noted July 26.

Tex., Odem—Dec. 7, by City, c/o E. S. Butler, mayor, constructing waterworks, incl. pumphouse, water tapping machine, c.i. pipe, galvanized pipe, gate valves and boxes, fire hydrants, meters and steel water tank. $31,000. **P.W.A.** D. M. Duller, 1618 2nd Natl. Bank Bldg., Houston, consult. engr. Noted Aug. 30.

Ont., Kenora—Nov. 30, by Town Clerk, 2 direct connected motor driven centrifugal pumping units. W. M. Scott, Winnipeg, Man., engr.

Ont., Orillia—Dec. 3, by F. Grover, secy. Water Comm., two 2250 k.v.a. vertical water-driven generators, direct connected exciters, motor-generators, exciters, station feeders, outgoing feeders and switching equipment with necessary transformers to step voltage from 2300 v. to 44 k.v. at Workmans Falls, and transformers to step voltage from 44 k.v. to 2300 v. at Orillia. L. G. McNeice, c/o owner, engr.

LOW BIDDERS

Massachusetts—Commonwealth of Massachusetts, Metropolitan Dist. Water Supply Comm., 20 Somerset St., Boston, F. E. Winsor, ch. engr., Nov. 13, constructing dike of Quabbin Reservoir in towns of Enfield and Ware, embankment to be 2,140 ft. long, 135 ft. high and requiring about 2½ million cu.yd., about ⅔ of which must be placed hydraulically; concrete caisson cut-off has been constructed to ledge across the valley bottom under previous contracts. Work includes placing and consolidating foundation embrankment in preparation for hydraulic sluicing, placing concrete over and grouting ledge rock on 2 hillsides, placing rip rap on upstream and soil dressing on downstream faces, building roads and other appurtenant works, from Arthur A. Johnson Corp., 29-28 Hunter Ave., Long Island City, N. Y., $1,446,755. N. Le Roy, Hammond, div. engr. Noted Oct. 18.

CONTRACTS AWARDED

Ala., Hamilton—Town, K. T. Price, mayor, K. V. Kite, clk., one 8 in. drilled well, approximately 400 ft. deep, 75 gpm. capacity, to Falconer Constr. Co., Birmingham, $1,898. **P.W.A.** J. B. McCrary Co., 22 Marietta St. Bldg., Atlanta, Ga., engrs.

Calif., San Diego—H. J. Schaper, acting city purch. agt., constructing by-pass tunnel inner lining on El Capitan Reservoir Project, involving 2,920 cu.yd. concrete inner lining in place, 300 cu.yd. concrete in tunnel plug, 4,650 bbl. cement, 142,000 lb. reinforcing steel and 2,000 cu.ft. cement grout in place in the work, etc., to M. H. Golden, 404 California Bank Bldg., $53,178. Bids Oct. 30.

Ill., Eldorado—Eldorado Water Co., receivers for Municipal Waterworks, new pumping and filtration plant, to Palmer & Baugher Constr. Co., Eldorado, $14,200. Awarded Nov. 14. Noted Aug. 30.

Ill., Knoxville—City, turbine pump for waterworks plant, to A. D. Cook, Inc., Lawrenceburg, Ind., $4,174. Est. $4,000. **P.W.A.** Bids Nov. 3. Noted Oct. 25.

Ia., Stuart—City, sinking deep well, 144,000 gal. per day capacity, to Thorpe Bros. Well Co., 2340 6th St., Des Moines, $4,800. Est. $5,000. Bids Nov. 8.

Kan., Osborne—City, 90,000 gal. rein.-con. reservoir and rock fill dam, FERA labor. Est. $35,000. Wilson Eng. Co., Salina, engrs.

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Waterworks (Continued)

†La., Alexandria—Vet. Bu., Arlington Bldg., Wash., D. C., deep well pump and pump house at Veterans Administration Facility, to A. B. Blakemore, 823 Perdido St., New Orleans, $4,512. Bids Nov. 6.

Mich., Centerville—Village, C. P. Chester, village pres., 50,000 gal. elevated steel water tank, to Pittsburgh-Des Moines Co., 38 South Dearborn St., Chicago, Ill., $5,575***34 mi. c.i. water mains with fire hydrants, connections, to Ostrom Realty & Constr. Co., 624 Peoples Bank Bldg., Indianapolis, Inc., $18,265***36 in. gravel packed well, to Layne Northern Co., $1,756. Grand total $25,596. Est. $25,000. **P.W.A.** Noted Sept. 27.

Miss., Clinton—Town, waterworks improvements, well and pump, to Layne-Central Co., Chelsea Ave., Memphis, Tenn.; elevated tank, to R. D. Cole Mfg. Co., Newman, Ga. **P.W.A.** Bids Nov. 12.

Mo., Bolivar—City, 16,068 ft. 4- to 12-in. c.i. pipe, 6,000 lb. c.i. specials, 24 wet connections, 15 fire hydrants, 20 gate valves and boxes, etc., to W. A. Riley, Inc., 110 North 7th St., St. Louis, $18,087; 200,000 gal. steel tank on 125 ft. tower, to Pittsburgh-Des Moines Steel Co., 421 Southwest 4th St., Des Moines, Ia., $13,928. **P.W.A.** Bids Nov. 5.

N. Y., Bethlehem — Water Comrs., watermains, to G. Ferullo, Inc., 31 Milk St., Boston, Mass., $30,491***wire fence, to F. K. Blanchard, Inc., Troy, $2,548***water softener and wash water tank, to F. G. Blair & Sons, Hilton, $11,015. Grand total $44,054. **P.W.A.** Bids Oct. 15. Noted Oct. 11.

N. Y., Elba—City, valves and hydrants for waterworks, to Darling Valve & Mfg. Co., Williamsport, Pa., $1,610***tubing, stops, boxes, to Columbian Iron Wks., Chattanooga, Tenn., $621***c.i. pipe, to Florence Pipe, Fdry. & Machine Co., Florence, N. J., $15,209. Grand total $17,440. **P.W.A.** Noted Nov. 8, under "Contracts Awarded."

N. Y., Mount Pleasant—City, water extensions, to Di Marco & Ciccone, 151 East Post Rd., White Plains, $15,584. **P.W.A.**

N. Y., Niagara Falls—City, intake line filtration plant, to F. L. Cohen, Prud. Bldg., Buffalo, $122,322. **P.W.A.** Bids Oct. 13. Noted Oct. 11.

Okla., Sayre—City, tank on tower, to Pittsburgh-Des Moines Steel Co., Praetorian Bldg., Dallas, Tex., $18,460; waterworks extension, to B. & M. Constr. Co., Insurance Bldg., Oklahoma City, $15,468. Est. $40,000. **P.W.A.** Bids Nov. 5.

Pa., Conneautville—Village, constructing new pump house at waterworks in Mulberry St., installing new 4 in. c.i. watermains in Depot St., Turkey Track and Cussewago Rds., grading, draining athletic field at vocational high school and grading, improving waterworks park, day labor under supervision of engr. Est. $28,000. RWD project. C. Ellis, Conneautville, supt. in charge.

S. C., Loris—Town, water supply and distribution system, and pumping station, to Wannamaker & Wells, Inc., Spartanburg, $19,465. Est. $31,000. **P.W.A.** Bids Nov. 13.

Tex., Fort Worth—City, c/o G. D. Fairtrace, mgr., will purchase material and construct with force account, water extension in Forest Hills to take care of U.S. Narcotic Farm. Est. $30,000. D. L. Lewis, Fort Worth, engr. **Maturity about Jan. 1.**

Tex., Naples—City, c/o Z. Z. Smith, mayor, waterworks system, involving 19,700 ft. 2- to 8-in. c.i. pipe, fire hydrants, valves, deep well, well pump, 50,000 gal. elevated tank, 50,000 gal. surface reservoir, pumping station, pumping equipment, general contract to W. G. Cullum, Central Bank Bldg., Dallas, $28,620*** deep well and pump, to Layne-Texas Co., 6931 Hsbg., Houston, $6,533***elevated steel tank, to Pittsburgh-Des Moines Steel Co., Praetorian Bldg., Dallas, $5,550***250 gpm. pump and 500 gpm. pump, to A. M. Lockett & Co., Magnolia Bldg., Dallas, $396 and $507 respectively. Grand total $41,606. **P.W.A.** Bids Nov. 7.

Wis., Kenosha—Co. Park Bd., constructing well, to J. Egerer, 1012 North 3rd St., $9,200. Bids Oct. 27.

Wis., Shawnee—Municipal Water & Electric Dpt., constructing 250,000 gal. semi-elliptical bottom steel tank, to Pittsburgh-Des Moines Steel Co., 38 South Dearborn St., Chicago, Ill., $14,775. Bids Oct. 22. Noted Oct. 18.

Wis., Waukesha—Bd. Trustees, Waukesha Co., furnishing centrifugal pumps, etc., to American Well Wks., Aurora, Ill., $2,585. Bids Oct. 2, awarded Nov. 9. Noted Mar. 15.

SEWERAGE AND WASTE DISPOSAL

PROPOSED WORK

Calif., Half Moon Bay—Directors of Half Moon Bay Sanitary Dist. rejected bids Sept. 7 constructing 18,900 ft. 6 in., 6,200 ft. 8 in. sanitary sewers, 2,900 ft. 4 in. lateral sewer, 88 standard type manholes, 510 ft. 6 in. outfall pipe, 1 complete sewage treatment plant. Noted Sept. 17 Daily.

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Calif., Oxnard—City bids early in December sewage disposal plant. $54,000. Bonds approved Nov. 9. Currie Eng. Co., San Bernardino, engrs.

Calif., San Mateo—City voted $85,000, sewer and sewage disposal plant. Burlingame and Hillsborough will assist in financing and has funds available for purpose.

Conn., Farmington—Town making plans 5,2[illegible] ft. sewer main and disposal plant, pumping station sludge beds to keep pollution from Farmington River. $100,000. Town appropriates $20,000 for initial work. Henry Robinson Buck, Inc., 650 Main St., Hartford, engr. Noted Oct. 5, 1933.

Minn., Rochester—City plans complete trunk line sewer, part of which was built this year, $45,000. C. H. Armstrong, city engr.

N. J., Bradley Beach—Boro plans enlargement Evergreen Avenue Sewage Disposal plant. $54,000. P.W.A. project.

N. J., Flemington—Mayor and City Council postponed until midwinter action to construct sewage disposal plant. $80,000.

N. J., Island Heights—Boro Council plans sewage disposal plant, and extending sewer mains, $66,000. P.W.A. funds allotted. G. McKaig, mayor. Noted Nov. 23, 1933.

N. Y., Riverhead—Riverhead Village Sewer Dist. made plans sewerage system, $350,000. F. J. Biele, Huntington, engr. Div. Sanitation of New York. State Dpt. Health approved plans. Seeking assistance from Federal Govt. Noted Oct. 11.

Okla., Clinton — City voted $29,000, new sewage disposal plant. $29,000. C. C. Smith, Clinton, engr. Noted Oct. 11.

Okla., Pauls Valley — City voted $25,000 sewer extensions in Rennie, Walnut and Pine Sts. E. E. Braden, city engr.

Pa., Franklin—Bd. Supervs., Sugarcreek Twp., Venango Co., H. B. Sigworth, clk., plans 2 interceptor sewers, 1 along 13th St., Franklin and other along north bank of Allegheny River from Eclipse Refinery to junction of river and French Creek. $58,700. **Maturity early in 1935.** J. McK. Snow, City Hall, twp. engr.

Pa., Greensburg—City plans preliminary survey for sanitary sewerage system extension, also repaving and resurfacing various streets. To exceed $25,000.

Tex., Austin—City, c/o J. G. Morgan, mgr., plans completed sewer improvements, incl. 36 in. vitr. clay pipe, 36 in. monolithic pipe with clay liner slabs, 36 in. precast concrete pipe, 36 in. Class A, c.i. pipe, $85,000. J. E. Motheral, city engr. P.W.A. project.

Wis., Minocqua—Town Bd. rejected bids Nov. 2, storm water and sanitary sewers and sewage treatment plant. Will readvertise in spring. Suhr, Berryman, Peterson & Suhr, 130 North Wells St., Chicago, Ill., engrs. Noted Oct. 25.

N. S., New Waterford—Municipal engineer preparing plans sewer construction. $36,000.

Ont., Chatham — City Council plans sewer construction, probably day labor. $46,120.

Ont., Collingwood—Town plans sewers to provide winter work for unemployed. $40,898.

Ont., Hamilton—City plans storm sewer in Cannon St. from Hughson to John St. and in John St. from Cannon to Main Sts., to serve new Federal and Post Office building, $52,700. W. L. McFaul, City Hall, city engr.

Ont., Kingston—City Council plans relief work, incl. sewers and concrete swimming tank. $35,000. H. Dick, city engr.

Ont., Orillia—City Council, plans sewage disposal system. W. G. McNiece, town engr.

Ont., Port Arthur—City Council making plans sanitary sewerage system in Brent Park area. $100,000. J. Antonisen, city engr.

BIDS ASKED

†Ind., Marion—Dec. 11, by Vet. Bu., sewage disposal plant, at U. S. Veterans Hospital. $45,000. Rejected Aug. 21 bids.

Ia., Oskaloosa — Nov. 27, by City Council, installing Northeast and Southwest Sewage Treatment Plant, and outfall sewer lines and sewage lift stations, incl. primary settling tank, trickling rock filter, humus tank, separate sludge digestion tank, mechanical equipment. $150,000. D. B. Russell, city engr. Noted Sept. 27.

Mich., Monroe—Nov. 26, by J. H. Eber, city clk., intercepting sewer, Sect. 1, river improvement and sewage disposal project, involving 10,209 ft. 30- to 48-in. sewers, manholes, connections and appurtenances; intercepting sewer, Sect. 2, of river improvement, and sewage disposal project North Side Interceptor Sewer, 7,305 ft. 12- to 36-in. vitr. concrete pipe, with manholes, etc. S. M. Weaver, city engr.

Mo., Monett—Nov. 27, by City, complete sewage disposal plant, filter type. $50,000. Burns & McDonnell Eng. Co., 107 Linwood Blvd., Kansas City, engrs. Noted Nov. 8.

N. Y., Bayside—Nov. 30, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, constructing private sanitary sewer for Bayside High

†Federal Government

Sewerage, etc. (Continued)

School, 32nd Dr., Corporal Kennedy, 208th and 209th Sts., 32nd Ave. and 33rd Ave., for Bd. Educ., 500 Park Ave., New York.

N. Y., Canton—Dec. 6, by Village, J. A. Bird, mayor, sewage treatment plant, $41,920. P.W.A. project. W. T. Field Engineers, Inc., Watertown, engrs. Noted Aug. 16.

N. Y., Hamburg—Nov. 30, at office Village Clerk, sewage treatment plant, $55,536. P.W.A. project. Noted Aug. 16.

N. Y., Long Island City—Nov. 26, by G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., sewers and appurtenances in 114th Rd., Westchester and 114th Aves., Palmetto, 178th, 180th, 176, 177th and 178th Sts.

O., Columbus—Dec. 4, by W. J. Lucks, dir. Service, preliminary treatment tanks at sewage disposal plant, also sludge removal and grit removal equipment, venturi meters, 87 tons various sized c.i. pipe, $301,987. P. W. Maetzel, City Hall, engr.

O., Washington C. H.—Dec. 4, by Bd. Control, intercepting sewers, sewage treatment plant, pumping station and equipment, incl. Div. A, 15,000 lin.ft. 27- to 10-in. sewers and appurtenances; Div. B, sewage pumping station, grit chamber, settling tanks, sludge pumping station, sludge digestion and storage tanks, sludge drying beds and appurtenances; Div. C, sewage pumping equipment; Div. D, movable cover for sludge digestion tanks, $157,000. J. Kent Hopkins, safety service dir. Greeley & Hansen, 6 North Michigan Ave., Chicago, Ill., engrs. Noted Nov. 1.

Pa., Laurelton—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Fresno—H. S. Foster, city clk., constructing storm water sewerage system, (North End Dist.), to Stewart & Nuss, and J. Jurkevich, 410 Thorne Ave., $29,170. **P.W.A.** Bids Oct. 20, awarded Nov. 13.

Ill., Edwardsville — City, sewage treatment plant with auxiliary piping and 6- to 27-in. vitr. clay sewers and 10- to 24-in. c.i. intercepting sewers and appurtenances, to J. Kesl & Sons Constr. Co., Edwardsville, $173,563. Est. $180,000. **P.W.A.** Bids Nov. 7. Noted Oct. 25.

Ky., Russellville — City, complete sewerage system throughout city, to Volz Constr. Co., Baltimore Bldg., Memphis, Tenn. **P.W.A.** allotted $96,000. **P.W.A.** Roberts & Co., Bonn Allen Bldg., Atlanta, Ga., engrs.

Mass., Boston—City, Dpt. P. Wks., C. J. Carven, comr., City Hall Annex, constructing Hyde Park Ave. sewerage outlet between Neponset River and Hyde Park Ave., to Jas. Chesarone, 915 Chestnut St., Newton, $36,872 (by machinery). **P.W.A.** Bids Oct. 30, awarded Nov. 9. Noted Oct. 25.

Mich., Detroit—Dpt. P. Wks., City Hall, furnishing, installing 1 centrifugal pumping unit in Fairview Pumping station (storm water sewage pumping station) pump and driving motor, General Electric Motor with Kingsbury Thrust Bearing, to Worthington Pump & Mchy. Co., 1219 Book Bldg., $64,400. Awarded Nov. 15.

Neb., Callaway — Village, sanitary sewerage system and sewage disposal plant, to H. J. Peterson Co., 3258 Grover St., Omaha, $22,615. Est. $22,676. **P.W.A.**

N. Y., Malone — City, pumps for sewage works, to Ames Pump Co., 30 Church St., New York, N. Y., $998; electrical work, to Hanna & Porter, Inc., Malone, $4,998. **P.W.A.**

O., Sidney—A. I. Guerry, dir. Service, storm relief sewer, Southwest side, to Kohiberger & Love, Sidney, $44,655 est. $49,000; storm sewer, to Hanagan Bros., Urbana, $14,990 est. $17,000. **P.W.A.** Bids Nov. 3. Noted Nov. 1.

Okla., Bartlesville — City, sewage disposal plant, to N. R. Grimshaw Co., Tulsa, $118,778. **P.W.A.** Bids Oct. 29. Noted Oct. 18.

Pa., Laurelton—State, laying new sewerage system at Laurelton State Village and grade grounds of state institutions there, day labor under supervision of P. F. Siegrist, engr. Union County, Lewisburg. To exceed $25,000. **Maturity at once.** $27,000 allotted for labor.

Pa., Williamsport—City, installing new storm sewers, removing trolley tracks from city streets, improving municipal tennis courts, day labor, under supervision of L. Mussina, city engr. Est. $50,000. RWD project. Noted Oct. 25.

S. C., Columbia—City, sanitary sewers in sections of Rose Hill, Shandon Annex, to Boyle Road & Bridge Co., Sumter, $170,555. **P.W.A.** Bids Oct. 31.

S. C., Hartsville—Comrs. P. Wks., Hartsville, J. L. Jordan, supt., extensions to sewerage system, and installing disposal plant, to A. H. Guion, 256 West Main St., Charlotte, $33,754. Bids Nov. 1. **P.W.A.**

Wis., Burlington—Bd. P. Wks., City Hall, sewage disposal plant, to Fluor Bros. & Smith, Oshkosh, $25,730. Bids Nov. 10. Noted Nov. 1.

B. C., Vancouver—Greater Vancouver & Dist. Joint Sewerage & Drainage Bd., rein.-con. trunk sewer with brick lining at bottom, in South Hill Dist. from 49th Ave. and Quebec St. to Fraser River, day labor, $400,000. Soon lets contract on materials for same. E. A. Cleveland, 1204 Bekins Bldg., engr. Noted Apr. 26.

Ont., Toronto — City, Dpt. P. Wks., relief sewer in Dundas St. from Ritchie Ave. to Sorauren Ave., to Ruscica Bros., 84 Woodycrest Ave., $56,964•••sanitary sewer in Kippendavie Ave. from Kew Beach to point near Buller Ave., to Ranco Bros., 295 Boan Ave., $2,635 •••drainage of creek at Glenmount Park Rd., to W. E. Taylor, 22 Falcon St., $8,677. Grand total $68,276.

Que., Montreal—City Executive, underground tunneling for sewer in Iberville St., from Rouen to Harbour front, to A. Janin Ltd., $56,400.

BRIDGES AND GRADE CROSSINGS

PROPOSED WORK

Indiana—State Hy. Comn., Indianapolis, plans overhead bridge at Lawrenceburg Junction, Dearborn Co., $110,000; new bridges, culverts on Road 30, Schererville, Lake Co., $63,000; bridge on Rd. 3, at Otisco, Clark Co., $34,000; grade separation at Glen, Vigo Co., $320,000; bridge west Fork Whitewater River, at Cambridge City, Wayne Co., $50,000; bridges on Rd. 64, DePauw, Harrison Co., $25,900; and on Rd. 31, New Albany, Floyd Co., $35,400. J. D. Adams, chn.

Indiana—State Hy. Comn., Indianapolis, plans bridge at 38th St. and Big Four Ry. grade separation, Marion Co. $75,000. J. D. Adams, chn.

Indiana — State Hy. Comn., Indianapolis, plans constructing bridge on Road 41, at St. John, grade separation Monon Ry., Lake Co., $40,000 bridge on Road 60, at Bennettsville, grade separation, Pennsylvania R.R., Clark Co., $19,000. State and Federal will share cost. J. D. Adams, chn.

Mass., Waltham—Commonwealth of Massachusetts, Dpt. P. Wks., 100 Nashua St., Boston, making plans rein.-con. overpass over railroad, Main St., Waltham. To exceed $50,000. A. W. Dean, 100 Nashua St., Boston, ch. engr.

Minn., Rochester—City plans 2 bridges, one 120 ft. span and other shorter span at 10th St., S.E., and 7th St. N.W. $35,000. C. H. Armstrong, city engr.

Mo., Liberty—Clay Co., bids in December, 3 story, basement, 87x117 ft., rein.-con., brick, Indiana limestone court house, $275,000, $75,500 allotted by P.W.A. F. D. Wallace, 114 West 10th St., Kansas City, archt. Wright & Wright, 400 1st Natl. Bank Bldg., Kansas City, engrs. Noted Oct. 18.

N. J., Paulsboro—State Hy. Comn., Trenton, bids early in December, constructing 90 ft. vertical lift span bridge over Mantua Creek. Est. about $100,000. Ash, Howard, Needles & Tammen, Orear Leslie Bldg., Kansas City, Mo., and 111 8th Ave., New York, engrs. Noted Nov. 8.

N. Y., Jamestown—Erie R.R. Co., G. S. Fanning, ch. engr., Midland Bldg., Cleveland, O., bids in January eliminating grade crossing at Fairmount Ave. $202,400. Public Service Comn. approved revised plans. Noted Oct. 18.

N. Y., Lockport—Bd. Supervs. Niagara Co., plans constructing steel, concrete bridge over Sawyer Creek, town of Wheatfield, connecting Schultz Rd. with Niagara Falls Blvd. To exceed $25,000.

N. Y., Mayville — Bd. Supervs. Chautauqua Co., plans highway bridges, $50,000. **Maturity in 1935.** E. Fitch, Falconer, co. engr.

N. Y., Riverhead—Bd. Supervs. Suffolk Co. approved appropriation for reconstructing Jockey Creek Bridge, Southhold, $50,000; Beach Lane Bridge, Westhampton Beach, $75,000; Centreport Bridge, Huntington, $20,000.

N. Y., Utica—City plans 1,900 ft. bridge 30 ft., over Mohawk River, on Barnes Ave., for eliminating grade crossing, incl. 8,775 cu.yd. concrete paving, etc., $292,700. J. E. Forte, City Hall, engr.

North Carolina—State Hy. & P. Wks., Raleigh, preparing plans constructing bridge at city limits of Wrightsville Beach, Project 3541, $45,000; underpass over S.A.L. Ry., Cherry St., Project 4931, Norlina, Warren Co., $40,000. W. L. Craven, Raleigh, bridge engr.

Pa., Jeannette—Pennsylvania R.R. Co., W. D. Wiggins, ch. engr. Central Div., c/o owner, Pittsburgh, completing plans for submission to Public Service Comn. for construction of overhead bridge across right-of-way Harrison Ave. $99,000. **Maturity 1935.**

Ont., Port Arthur—City Council plans 200 ft. steel bridge over Current River at Algoma St. J. Antonisen, city engr. has started plans for rock fill 800 ft. long in connection with bridge, $32,000. Noted Nov. 1.

BIDS ASKED

New York—See "Streets and Roads."

New York—Dec. 4, by Triborough Bridge Authority, 111 8th Ave., New York, construct-

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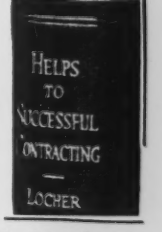

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Bridges, etc. (Continued)

ing Randalls Island and Little Hell Gate Piers of Triborough Bridge connecting Manhattan, Bronx and Queens Boros. Contr. 27.

Ohio—Nov. 30, by O. W. Merrell, dir. Hys., Columbus, constructing timber bridge with steel beams, over Markey Run, Sect. "B" Butler-Ankenytown Rd., Knox Co., $6,642.

Virginia—Dec. 4, by State Hy. Dpt., Richmond, constructing 116 ft. bridge on Route 1, NRH 379-C, Fed. Project NRH 362-C, Hanover Co.; 65 ft. bridge over Crane Nest River, Route 72, State Project NRH 494-B4, Federal Project NRH 351-H, Wise Co.; 1,416 ft. bridge over New River, at Lowman's Ferry, Route C-672, Pulaski Co.

Wis., River Hills—Dec. 4, by Village, C. Gardner, clk., rein.-con., stone bridge on Range Line Rd. $35,000. C. Whitney, Milwaukee, engr. Noted Nov. 16 Daily.

CONTRACTS AWARDED

Arkansas—State Hy. Comn., Little Rock, 2 bridges, one 161 ft. and other 737 ft. long, and 526 ft. earth embankment approaches, on Burdon-Whelen Springs Rd., Hy. 53, Sect. 2, Nevada Co., to Kochtitzky & Johnson, Forrest City, $25,686. Bids Nov. 8.

Arkansas—See "Streets and Roads."

California — State Hy. Comn., Sacramento, underground crossing consisting of 2 concrete abutments with wing walls and steel plate girder span and 0.26 mi. roadway to be graded and paved with concrete, under tracks of Atchison, Topeka & Santa Fe Ry., Union Ave., Bakersfield, Kern Co., to Rocca & Co., San Rafael, $69,618. Bids Oct. 31, awarded Nov. 9.

Connecticut — J. A. Macdonald, state hy. comr., Hartford, 60 ft. span rigid frame bridge and approaches, and 1,550 ft. rein.-con. paving at intersection of Merritt Hy. with Round Hill Rd., Greenwich, to Peter Mitchell, Inc., Greenwich, $86,708***64 ft. span stone faced triple arch bridge Wepewaug River, Milford, to Immick Co., State St. Ext., Meriden, $21,138. Bids Oct. 22. **P.W.A.** Noted Oct. 18, under "Streets and Roads."

Del., Townsend—Pennsylvania R. R. Co., Broad St. Sta. Bldg., Phila., Pa., T. J. Skillman, ch. engr., 6 span, 142 ft. bridge, to Empire Constr. Co., 31 South Calvert St., Baltimore, Md., $50,000.

Iowa—State Hy. Comn., Ames, 4 rein.-con. and 5 box culverts in Buena Vista Co. and 22 rein.-con. pipe and 16 rein.-con. box culverts in Ida and Sac Counties, to Forgie & Groth, Sioux Center, $1,508 and $13,240 respectively ***bridges in Mills Co., to E. A. Wickham & Co., Council Bluffs, $12,726***bridge in Wayne Co., to G. Jordan & Son, Centerville, $6,304. Grand total $33,778. **P.W.A.** Bids Nov. 6, awarded Nov. 12. Noted Nov. 1.

Kansas—State Hy. Comn., at office of County Clerk, Clay Center, 2-90 ft. steel truss spans, and 128 ft.-160 ft.-128 ft. continuous steel truss span bridge, Project 40N-23, NRH 284-F, Clay Co., to R. G. Aldridge, 1609 Nebraska St., Kansas City, Kan., $66,632. **P.W.A.** Bids Oct. 31, awarded Oct. 31. Noted Oct. 18, under "Streets and Roads."

Kansas—State Hy. Comn., at office of County Clerk, Iola, to F. H. Freeto, Pittsburg, 70 ft.-80 ft.-70 ft. continuous I-beam span bridge, Project 11-7, NRH 405-E, Elk Co., $17,456; three 28 ft.-35 ft.-35 ft.-35 ft.-28 ft. continuous slab span bridges for Project 54-36, NRH 367-H, Allen Co., $11,574, $11,519 and $11,602 respectively. Grand total $52,151. **P.W.A.** Bids Oct. 27. Noted Oct. 18, under "Streets and Roads."

Kansas—See "Streets and Roads."

Massachusetts—Commonwealth of Massachusetts, Dpt. P. Wks., F. E. Lyman, comr., 100 Nashua St., Boston, rein.-con. pile bridge, 627 ft. total span, involving 5,390 sq.yd. bituminous concrete surfacing on bridge and approaches over Bass River between Dennis and Yarmouth, to New England Foundation Co., 38 Chauncy St., Boston, $156,807. Est. $250,000. **P.W.A.** Bids Oct. 30. Noted Oct. 18.

Michigan—State Hy. Comn., Lansing, NRS B-2 of 57-3-2-C-2, NRS 5-7-4, Contr. 5, two 45 ft. span bridges 0.83 mi. gravel surfaced approaches, steel deck girder type with 2 semi gravity type abutments, etc., to L. A. Davidson, Williamston, $44,029; NRS B1 of 57-15-3C-1, having two 35 ft. steel deck girder spans, 2 concrete, semi-gravity type abutments, to F. Price, Lansing, $21,265, both Missaukee Co. **P.W.A.** Bids Nov. 2.

Minnesota—State Hy. Dpt., St. Paul, constructing Bridge 5296, Project 14-7-21-2, near Eagle Lake, Blue Earth Co., to W. O'Neil Sons Co., Faribault, $25,430***Bridge 5395, NRH 142-A, near Motley, between Cass and Morrison Counties, to P. Steenburg Constr. Co., W-1757 1st Natl. Bank Bldg., St. Paul, $39,878. Bids Nov. 2. Noted Oct. 25.

Missouri — State Hy. Dpt., Jefferson City, bridges over Hoskins Creek, Clinton Co., to List & Clark Co., Kansas City***over levee ditch, New Madrid Co., to Juland Constr. Co., St. Louis***over North Fork, Sniabar Creek, Lafayette Co., to J. L. Pohl, Nevada***over Clare Creek and over O'Neal Branch, Pike Co., to P. McGlone, City Bank Bldg., Kansas City*** over drainage ditch, over Spring Branch, over Marais Des Cygnes River, Bates Co., to O. Knutson, Kansas City***over Tedrick Creek, Stoddard Co., over Juden Creek, Cape Girardeau Co., and over Main Ditch Dist. 8, Pemiscot Co., from R. E. Brown, Cape Girardeau***over Schl Creek and over Roesuer Creek, St. Charles Co., over Pin Oak Creek and over branch Pin Oak Creek, Franklin Co., to Davis Constr. Co., Boonville***over Big Tarkio Creek, Holt Co., and over Thompson Fork Grand River, Livingston Co., to F. M. Clark, Savannah***under King's highway and under Jefferson Dr., St. Louis Co., to City of St. Louis, City Hall, St. Louis***over Rambling Willie Creek, over Corner Creek and over Walnut Fork, Gentry Co., to La Constr. Co., North Kansas City, and Henderson Constr. Co., Richmond***over Pike Lake Ditch and over Small Creek, Butler Co., to M. E. Gillioz, Monett***over Big Monegaw Creek and St. Clair Co. over Scaly Bark Creek, Johnson Co., to J. Spitcaufsky, Kansas City. Bids Nov. 2. Noted Oct. 26.

North Carolina — State Hy. and P. Wks., Raleigh, structures on 6.98 mi. Project 6290, Catawba Co., and on 11.65 mi. P. 6410, Iredell Co., to Hobbs-Peabody Constr. Co., 317 West Worthington Ave., Charlotte, $24,397 and $25,884 respectively. Bids Nov. 7. Noted Nov. 1, under "Streets and Roads."

Oklahoma—State Hy. Dpt., Oklahoma City, bridges in McIntosh Co., to Moran & Buckner, Muskogee, $93,087 est. $109,048***Adair Co., to T. C. Ottinger, Hinton, $6,442 est. $7,700*** Garvin Co., to Merveldt & Lawson, El Reno, $20,916 est. $24,000. Grand total $120,445. Bids Nov. 7. **P.W.A.** Noted Nov. 1.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, 188 ft. alterations and additions to south span approach viaduct Route 72, Butler City, Butler Co., to W. S. Rae, 2534 Koppers Bldg., Pittsburgh, $6,609; 0.45 mi. through truss and plate girder bridge, also rein.-con. paving Route 69 and 203, Sect. 9, Leechburg and West Leechburg Boroughs, Allegheny Twp., Armstrong and Westmoreland Counties, to Freeland, McHale & Patten, 1 Penn Ave., Pittsburgh, $279,693. **P.W.A.** Bids Nov. 2. Noted Oct. 25, under "Streets and Roads."

Tex., Wharton—Wharton Co., c/o J. Morris, judge, constructing 15 vehicular bridges, wood, concrete, structural steel, steel construction, on lateral hys., to Thomas & Ratliff, Rogers, $103,892. **P.W.A.** Bids Oct. 31. Noted Oct. 25.

†Washington—Bureau Reclamation, Almira, constructing Columbia River Highway Bridge, at Grand Coulee Dam, Columbia Basin Project, about 22 mi. northwest of Almira, to J. H. Pomeroy & Co., 533 Montgomery St., San Francisco, Calif., $258,928. Bids Oct. 18. Noted Sept. 27.

STREETS AND ROADS

BIDS ASKED

Ill., Paxton—Nov. 28, by Dpt. P. Wks. & Buildings, Div. Hys., traffic bound surface course on 2.0813 mi. Sect. 8-MFT, Ford Co., G. H. Baker, engr. co. roads and city streets.

Indiana—Nov. 27, by State Hy. Comn., Indianapolis, rein.-con., brick, asphalt or bituminous concrete paving 0.08 mi. east of Angola, R-992, F.A. 54-A1, Steuben and Fort Wayne Counties; 0.084 mi. east of Kendallville, F.A. 106-A1, Noble Co.; 6.884 mi. at Waterloo, F.A. 401-A, DeKalb and Steuben Counties; 8.133 mi. Worthington-Freedom Rd., R-993, Project 135B, Green and Owen Counties; 8.323 mi. Freedom-Spencer Rd., R-944 135-C, Owen Co.; 6.154 mi. Brownstone to 6 mi. west, R-995, Project 156-D, Jackson Co.; 4.239 mi. west of Ramsey to New Salisbury, R-999, Project 302-A, Harrison Co.; 5.98 mi. New Salisbury to Georgtown, R-1001, 322-A, Harrison and Floyd Counties; placing stone and back fill and rip rap 0.026 mi. east of Newburg, R-996, Project 172-A2, Warrick Co.; crushed stone surfacing 10.577 mi. from S.R. 59 to point 5.5 mi. southeast of Bowling Green, R-997, Project 255-B, Clay and Owen Counties; 9.621 mi. from point 4 mi. northeast of Vandalia to Spencer, R-998, Project 225-C, Owen Co.; 10.496 mi. Lynnville-Selvin Rd., Route R-1000, Project 319A, Warrick Co.; grading, crushed stone surfacing 8.056 mi. north of Laconia, R-1002, NRS 386-B, Harrison Co.; 1.655 mi. Crandall south to S.R. R-64, Project 480, R-1004, Harrison Co.; grading, crushed stone or graveling 1.848 mi. Wilbur South, R-1003, Project 442, Morgan Co.

Iowa—State Hy. Comn., Ames, cancelled bids to have been opened Nov. 20, paving 4.781 mi. U. S. Rd. 30, out of Missouri Valley West, Harrison Co. Noted Nov. 15.

Ia., Elkader—Dec. 3, by Clayton Co., crushed limestone surfacing 10.2 mi. County Trunk Road G; 5.24 mi. county road from intersection with county trunk Road G, on Delaware Co. line northeast; 10.5 mi. County Trunk Rd. G, from intersection with P. R. 13 south to Elkader and southeast to Elkport; 4.5 mi. County Trunk Rd., from Delaware Co. line northeast.

Louisiana—Nov. 28, State Hy. Comn., Baton Rouge, concrete paving 0.437 mi. Route 4, Project 4050, Lincoln Parish.

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†Federal Government.

Streets and Roads (Continued)

Miss., Grenada—Dec. 3, by Mayor, and Bd. Aldermen, guttering, storm sewers, concrete paving 700 ft. South Main St.; curbing, guttering, concrete paving 1,800 ft. Fairfield Ave., etc. Former bids rejected. W. E. Johnson, P. O. Box 323, engr. Noted Oct. 25.

†**Montana**—Pub. Rds., Post Office Bldg., Portland, Ore., soon takes bids grading, etc., 6 mi. Bitterroot Salmon Hy., Ravilla Co.

New Hampshire—Nov. 28, by State Hy. Dpt., Concord, gravel surfacing 2,403 cu.yd. North Sandwich Rd., Tamworth, Carroll Co., involving 2,399 cu.yd. earth excav., $7,000; 4,345 cu.yd. Daniel Webster Hy., Stratford, Coos Co., 26,692 cu.yd. earth excav., $59,000. C. P. Riford, Concord, engr.

New Jersey—Dec. 3, by State Hy. Comn., Trenton, grading, rein.-con. and concrete paving, etc., 1.253 mi. Route 25, Sect. 13, from Beverly-Roncocas Rd. to Bridgeboro, Burlington Co., incl. 8,820 cu.yd. unclass. excav. A. L. Grover, ch. clk.

New York—Dec. 4, by A. W. Brandt, comr. Hys., Albany, graveling 3.34 mi. road in Clinton Co.; 2.85 mi. Columbia Co.; 5.13 mi. Delaware Co.; 2.88 mi. Franklin Co.; 5.06 mi. Monroe Co.; 6.22 mi. Orange Co.; 4.38 mi. Orleans Co.; 5.53 mi. St. Lawrence Co.; preliminary grading, etc., 0.82 mi. Kings and Queens Counties; bituminous treated surfacing 4.25 mi. Schoharie Co.; bituminous macadam paving 2.63 mi. Ulster Co.; 7.58 mi. Schenectady and Albany Counties; 30 ft. concrete and 65 ft. beam bridges, Orange Co.; and bridge in Oswego Co.

N. Y., Brooklyn—Nov. 28, by R. V. Ingersoll, pres. Brooklyn Boro, Boro Hall, asphalt on concrete paving McDonald Ave.

N. Y., Mayville—See "Contracts Awarded."

Ohio—Nov. 30, by O. W. Merrell, dir. Hys., Columbus, grading, drainage structures, widening and resurfacing with hot mixed asphaltic concrete or Westphalt and constructing parking strips on each side and installing sandstone curb on part of road 3.041 mi. Sects. A-1 and Tiffin (part) Upper Sandusky-Tiffin Rd., Seneca Co., $116,726; grading, building culverts, concrete paving 1.466 mi. Sect. "Marietta" Marietta-Highwater Rd., Marietta, Washington Co., $82,709.

Ohio—O. W. Merrell, dir. Hys., Columbus, rejected bids Nov. 2, grading, draining, brick paving, incl. furnishing, delivering brick and landscaping 1.389 mi. Sects. "J" (part) and "Clyde" (part) Fremont-Bellevue Rd., Sandusky Co., $146,537. Noted Oct. 25; rescinded contract for grading, widening and hot mixed asphaltic concrete paving 2.214 mi. Sect. "R" (part) Hillsboro-Washington C. H. Rd., Highland Co., Noted Nov. 15, under "Contracts Awarded."

Virginia—Dec. 4, by Dpt. Highways, Richmond, macadam paving 2.3 mi. Route 11, State Project NRH-151DR2, Fed. Project NRH-420F, Wythe Co.; 1.8 mi. same route, State Project NRH-361-1 NRM-361-J1, Fed. Project NRH-361-E, NRM 361-J1; 0.99 mi. same route, State Project NRH-361-A1C1, NRM .603-J, Federal Project NRH-361-G1, both Smythe Co.; 0.38 mi. Route 15, State Project NRM-781-E, Fed. Project NRM-346-C, Farmville; grading, draining 2.3 mi. Route 6, NRH-680-FB5, 6, Fed. Project NRH-487-A, Albermarle Co.; rein.-con. paving 0.08 mi. Route 1, State Project NRH-M-1033-DC, Fed. Project NRH-M-40-U1-2, Dinwiddie; 0.48 mi. Route 60, State Project NRM-1039-EF1, Federal Project NRM-381-IH, Newport News; soil on 0.3 mi. Route 27, State Project NRH-279-C, NRH 424-B, Norfolk Co.

CONTRACTS AWARDED

†**Arizona**—Pub. Rds., Phoenix, placing subgrade reinforcement and base course on 6.585 mi. road in Coconino and Gila Counties, to Tiffany Constr. Co., San Jose, Calif., $31,129. Est. $31,400. Bids Oct. 16.

Arkansas — State Hy. Comn., Little Rock, grading, drainage structures, concrete paving 4.3 mi. Eldorado-Junction City Rd., Hy. 167, Union Co., and concrete paving 4.7 mi. Wynne-Forrest City Rd., Sect. 13, Cross Co., to Hartmann-Clark Bros. Co., Peoria, Ill., $123,853 and $93,757 respectively***grading, drainage structures, rein.-con. and structural steel railroad underpass 1.2 mi. Gilham Connection, Hy. 71, Sect. 7, Sevier Co., to W. P. McGeorge, Pine Bluff, $38,662. Grand total $256,272. Bids Nov. 8.

California — State Hy. Comn., Sacramento, grading, asphaltic concrete paving 1 mi. hy. between Selma and Fowler Switch Canal, Fresno Co., to Union Paving Co., Call Bldg., San Francisco, $57,635. Bids Oct. 17, awarded Nov. 13. Noted Oct. 4.

†**California**—Pub. Rds., 461 Market St., San Francisco, grading Sect. A, Federal Lands Highway Project 6, Lava Beds Hy. and Sect. Route 11-Lava Beds Natl. Forest Hightway, Modoc Co., to R. R. Carlson, P. O. Box 407, Vallejo, $68,115. Est. $82,945. Bids Oct. 25, awarded Nov. 5.

California — State Hy. Comn., Sacramento, grading, concrete paving 3.8 mi. hys. between Gaviota Creek and Nojoqui Creek, Santa Barbara Co., to Hanrahan-Wilcox Corp., Hobart Bldg., San Francisco, $375,985. Bids Oct. 31, awarded Nov. 7.

†*Federal Government.*

California—State Hy. Comn., Los Angeles, grading, asphaltic concrete paving 4.4 mi. hy. between Newhall Tunnel and Saugus, Los Angeles Co., to Oswald Bros., 3366 East 58th St., Los Angeles, $85,505. Bids Nov. 1, awarded Nov. 9.

California—State Hy. Comn., Los Angeles, grading, bituminous macadam on crusher run base paving 1.9 mi. hy. between Military Reservation and Canon St., San Diego, San Diego Co., to V. R. Dennis Constr. Co., 3911 5th Ave., San Diego, $43,862. Bids Nov. 1, awarded Nov. 13.

†**Colorado**—U. S. Eng., Custom House, Denver, dense aggregate plant mix surfacing oil on 31.971 mi. Project PEC A-1, B, C, Fall River Hy., Rocky Mountain Natl. Park, to C. F. Hallenbeck, 251 Kalamath St., Denver, $223,900.

Connecticut — J. A. Macdonald, state hy. comr., Hartford, bituminous macadam on broken stone paving 28,472 ft. Route 80, Madison and Killingworth, NRH 59B, to Osborn-Barnes Co., Danbury, $483,745***2½ in. bituminous macadam on 6 in. broken stone paving 36,578 ft. Cat Hole Pass Rd., Route 71, Berlin and Meriden, to L. Suzio Constr. Co., Meriden, $256,-621***3 in. sheet asphalt on concrete paving 5,013 ft. Main Ave., Route 7, Norwalk, to P. Bacco, Stamford, $47,168***2½ in. bituminous macadam on 6 in. broken stone paving 1,325 ft. by Stafford, to Romeo & Hyde, Rockville, $10,408***track rock waterbound macadam paving 6,800 ft. Granville Rd., Hartland, to E. B. McGurk, West Hartford, $34,602***3,897 ft. Bartlett St., Portland, from Bloomfield Constr. Co., Bloomfield, $24,455***rein.-con. paving 272 ft. and bituminous macadam paving 521 ft. Brownstone St., Portland, to A. Brazos & Sons, 56 Oak St., Middletown, $4,784. Grand total $837,328. **P.W.A.** Bids Oct. 22. Noted Oct. 18.

Florida — State Roads Comn., Tallahassee, clearing, grubbing, grading 1.515 mi. Rd. 4, NRH 143-A, Duval Co., to Curry & Turner, Bradenton, $46,494***rein.-con. paving 0.237 mi. Rd. 1, NRM 109, Escambia Co., to Noonan Constr. Co., Pensacola, $25,039***sand clay surfacing 2.664 mi. Rd. 37, NRS 147, Santa Rosa Co., to John E. Ballenger Constr. Co., Lakeland, $28,707***clearing, grubbing, grading, sand clay surface treating, drainage structures 2.103 mi. Rd. 37, Project 837, santa Rosa Co., to M. J. Carroll, Inc., Ocala, $20,608***clearing, grubbing, grading 24,741 sq.yd. Ocala limerock base course (double course) 8½ in. thick and 288 sq.yd. Ocala limerock base course (single course), 6½ in. thick, Rd. 210, NRS 148, Pasco Co., to W. L. Cobb Constr. Co., 1st Natl. Bank Bldg., Tampa, $53,285. Grand total $174,233. **P.W.A.** Bids Nov. 8.

Ind., Connersville—Fayette Co., liquid asphalt paving 8.1 mi. highway through Harrisburg, to Whitewater River, 25 ft., to Rohe & Lyons, Everton, $23,070. J. B. Henry, Connorsville, aud.

Ind., Crown Point — Lake Co., bituminous mulch repaving 8.3 mi. Dryer-Brunswick Rd., to Koppers Products Co., Hammond, $26,114. J. E. Finerty, Crown Point, aud.

Ind., Delphi—Carroll Co., bituminous macadam paving 7.7 mi. highway through Cutler, 25 ft., to J. T. Kirkpatrick, Flora, $22,322. J. L. Whiteman, Delphi, aud.

Ind., Knox—Starke Co., liquid asphalt surfacing 8 mi. highway through English Lake along Kankakee River, 25 ft., to Chester Orr, North Judson, $22,471.

Iowa—State Hy. Comn., Ames, concrete paving 3.964 mi. road in Buena Vista Co., to Union Constr. Co., 200 York St., Des Moines, $96,977***1,006 mi. Warren Co., to Amodeo Paving Co. Des Moines, $49,371***grading 8,762 mi, Ida and Sac Counties, to W. H. Dugan & Sons, Danbury, $22,238***0.699 mi. Monona Co., to V. L. Lundeen, Montezuma, $4,859. Grand total $173,443. **P.W.A.** Bids Nov. 6, awarded Nov. 12. Noted Nov. 1.

Kansas—State Hy. Comn., Salina, (**P. means Project**), sand gravel surfacing 4.997 mi. P. 18-12, NRS 481-A, and 6.924 mi. P. 18-12, NRS 481-B, both Ottawa Co., to Cook & Cone, Ottawa, $6,522 and $9,036 respectively***7,011 mi. P. 9-13, NRH 442-B, Cloud Co., to D. G. Hansen, Logan, $7,193***earthwork and culverts 2.447 mi. P. 81-16, NRH 44-ABE, Saline Co., to M. Haase, St. Joseph, Mo., $65,113*** 10.651 mi. P. 14-19, NRH 467-A, Mitchell Co., to Gerard Knutson Constr. Co., 3520 Main St., Kansas City, $44,825***roadside improvement 10.651 mi. P. 14-19, NRH 467-A, Mitchell Co., to Campbell & Lachenmaier, Miltonvale, $942***2.447 mi. P. 81-16, NRH 44-ABE, Saline Co., to A. L. Cook, Ottawa, $732***55 ft.-65 ft.-55 ft. continuous I-beam span bridge, P. 13-7, NRH 363-E, Morris Co., to O. K. Parsons, Altamont, $14,210. Grand total $148,573. **P.W.A.** Bids Oct. 23, awarded Oct. 31, Noted Oct. 18.

Kansas—State Hy. Comn., Iola, (**P. means Project**), to Chandler Landscape & Floral Co., 101 West 47th St., Kansas City, roadside improvement 1.641 mi. P. 11-7, NRH 405-E, Elk Co., $190***to A. L. Cook, Ottawa, 2.031 mi. P. NRS 479-B, Wilson Co., $443; 1.318 mi. P. 54-36, NRH 367-H, Allen Co., $324***to Cook Gardens, Ottawa, 0.412 mi. P. 160-41, NRM 282-E, Labette Co., $222***to Holsinger Nursery Co., 24th St. and Merriam Blvd., Kansas City, 2.036 mi. P. 160-41, NRH 282-A, $1,032; 1.261 mi. P. 160-41, NRH 282-B, $1,-425, both Labette Co., 0.997 mi. P. 166-11, NRH 285-A, Montgomery Co., $1,678***to W. L. Hampson, Eldorado, earthwork and culverts 1.641 mi. P. 11-7, NRH 405-E, Elk Co., $8,400***to Scherrer & Bennett, Kansas City, Kan., 1.318 mi. P. 54-36, NRH 367-H, Allen Co., $30,516***to Harrison Eng. & Constr. Co., Fairfax Bldg., Kansas City, concrete paving 2.031 mi. P. NRS 479-B, Wilson Co., $52,099***to Joyce-Logan Co., Kansas City, Mo., 0.412 mi. P. 160-41, NRM 282-E, Labette Co., $41,-956; 0.17 mi. P. 7-17, NRM 293-I, Miami Co., $10,398. Grand total $148,692. **P.W.A.** Bids Oct. 27, awarded Oct. 31. Noted Oct. 18.

Kansas — State Hy. Comn., Witchita, (**P. means Project**), to Campbell & Lachenmaier, Miltonvale, earthwork and culverts 11.228 mi. P. 8-14, NRH 389-D, $40,506***to E. D. Reed, Clay Center, 6.596 mi. P. 37-1, NRH 115-A, Edwards Co., $19,338***to A. L. Cook, Ottawa, roadside improvements 11.213 mi. P. 8-14, NRH 389-D, $1,604***to Lawson Landscape Service, McPherson, 0.471 mi. P. 87-7, NRM 130-D, Sedgwick Co., $160; 0.596 mi. P. 37-1, NRH 115-A, Edwards Co., $894***to Stanley & Tidd, Hutchinson, 0.754 mi. P. 81-6, NRM 130-D, $130; 0.754 mi. P. NRS 115-A $264; 1.056 mi. P. 81-7, NRH 130 ABZ, $812, foregoing in Sedgwick Co.***to C. I. Erickson, Assaria, three 10x10x32 ft. span rein.-con. bridge, $2,-797; three 14x14x46 ft. span rein.-con. bridge, $6,905, both on P. 8-14, NRH 389-D, foregoing in Barton Co.***to Globe Constr. Co., Wichita, concrete paving 0.754 mi. P. NRS 511-A, $39,367; bituminous filled brick paving 1.056 mi. P. 81-7, NRH 130-ABZ, $70,555; concrete paving 0.471 mi. P. 81-70, NRM 130-D, $12,594***to Imperial Constr. Co., Leavenworth, concrete and modified sheet asphalt paving 0.158 mi. P. 81-6, NRM 130-D, 111, $11,-733, all foregoing in Sedgwick Co.***to E. W. King, Hesston, eight 25 ft. span rein.-con. deck girder bridge, P. 37-1, NRH 115-A, Edwards Co., $13,054. Grand total $220,713. **P.W.A.** Bids Oct. 26, awarded Oct. 31. Noted Oct. 18.

Kansas—State Hy. Comn., at office County Clerk, Atwood, (**P. means Project**) to Campbell & Lachenmaier, Miltonvale, roadside improvement 0.444 mi. P. 40N-16, NRH 371-A, Osborne Co., $199***to Holsinger Nursery Co., 24th St. and Merriam Blvd., Kansas City, 0.47 mi. P. 25-13, NRH 241-E, $1,354; 0.266 mi. P. 25-13, NRM 241-F, $428, both Thomas Co. ***to A. L. Cook, Ottawa, earthwork 0.444 mi. P. 40N-16, NRH 371-A, Osborne Co., $14,977; roadside improvement 5.707 mi. P. 9-1A, NRS 512-A, Sheridan Co., $212; 1.094 mi. P. 183-1B, NRM 462-D, Decatur Co., $457***to Cook Gardens, Ottawa, 3.104 mi. P. 183-2, NRH 462-C, Decatur Co., $3,313***to Cook & Ransom, Ottawa, 2-0x8x57 ft.-10 in. rein.-con. bridge, $3,797; 4-8x6x60 ft.-10 in. rein.-con. bridge, $4,504, both on P. 183-1B, NRH 462-D, Decatur Co.***to D. G. Hansen, Logan, earthwork and culverts 1.094 mi. P. 183-1B, NRM 462-D, Decatur Co., $33,511; sand graveling 3.801 mi. P. 83-23, NRH 343-E, Phillips Co., $4,413*** to List & Clark, Railway Exchange Bldg., Kansas City, Mo., earthwork and culverts 2.466 mi. hy., $23,476; roadside improvement 2.466 mi. hy., $336, both P. NRS 510-A; earthwork and culverts 2.966 mi. hy., $72,468; 2-12x12x 112 ft.-9½ in. rein.-con. bridge, $8,891; 3-14x14 x74 ft. rein.-con. bridge, $10,377; roadside improvement 2.966 mi. hy., $798, foregoing on P. NRS 510-B, Rawlings Co.***to Perry Constr. Co., McLouth, earthwork and culverts 5.707 mi. P. 9-1A, NRS 512-A, Sheridan Co., $17,280. Grand total $200,791. **P.W.A.** Bids Oct. 30, awarded Oct. 31. Noted Oct. 18.

Kansas—State Hy. Comn. at office of County Clerk, Clay Center (**P. means Project**), to Campbell & Lachenmaier, Miltonvale, roadside improvement 0.524 mi. P. 40N-23, NRH 284-F, Clay Co., $154***to Cook Gardens, Ottawa, 0.427 mi. P. 36-18-A, NRM 192-E, $66; 0.298 mi. P. 36-17, NRM 192-D, $90***to D. L. Wheelock, Clay Center, earthwork and culverts, bituminous filled brick paving 0.208 mi. hy., $11,040; 2-9x8x64 ft. 8 in. 30 degree skew span bridge, $3,414, both on P. 36-17, NRM 192-D; earthwork and culverts and bit. filled brick paving 0.427 mi. P. 36-18A, NRM 192-E, $20,608, all foregoing in Jewell Co.***to R. G. Aldridge, 1609 Nebraska St., Kansas City, Kan., earthwork and culverts 0.524 mi. P. 40N, NRH 284-F, Clay Co., $5,640. Grand total $41,012. **P.W.A.** Bids Oct. 31, awarded Oct. 31. Noted Oct. 18.

Kansas — State Hy. Comn., Hiawatha, (**P. means Project**), to A. V. Eulich, Kansas City, Mo., concrete paving 0.077 mi. P. 50S-32 NRM 30-E, Part 1, $3,725; and 0.352 mi. P. 50S-33 NRM 30-E, Part 2, $15,331, both Lyon Co. ***to Brosnahan Bros., City Bank Bldg., Kansas City, Mo., earthwork and culverts, concrete paving 3.272 mi. P. 36-34 NRH 348-A, Brown Co., $106,328; earthwork, culverts 1.909 mi. P. NRS 470-C, Osage Co., $42,184; 30 ft.-30 ft.-60 ft. 30 ft.-30 ft. rein.-con. deck girder bridge, NRS 470C, $11,074; 31 ft. span welded steel railroad bridge, P. NRS 470-C, $11,298, all foregoing in Osage Co.; to Cook Gardens, Ottawa, roadside improvement 1.909 mi. P. NRS 470-C, Osage Co., $356; 3.272 mi. P. 36-34, NRH 348-A, Brown Co., $556***to Roberts

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Streets and Roads (Continued)

Constr. Co., Wichita, sand gravel surfacing 16.5 mi. P. 36-35-6287, Doniphan Co., $7,491. Grand total $198,343. **P.W.A.** Bids Nov. 2. Noted Oct. 25.

†La., Shreveport—U. S. Eng., Barksdale Field, paving, water and air service pits, sidewalks, etc., in Barksdale Field, to J. G. Marston Co., Shreveport, $19,393. Bids Oct. 25.

Maine—State Hy. Comn., Augusta, L. D. Barrow, ch. engr., gravel surfacing 0.91 mi. Project NRH 141-C, Norway, C. E. Horne, Millbury, Mass., $17,807***0.54 mi. Project NRH 146-C, Sandy River, to W. H. Hinman, Inc., Skowhegan, $50,205. **P.W.A.** Bids Oct. 31, awarded Nov. 8.

Maryland — State Roads Comn., Baltimore, concrete paving 0.59 mi. Contr. P-168-1-39, Federal Aid Project NRS 352A, Prince George Co., to M. J. Grove Lime Co., Lime Kiln, $24,-763***bituminous surface course Spec. "C" paving 3.37 mi. Contr. B-298-2-48, H-169-2-48, Federal Aid Project NRH 7A-Units 2 and 70, Baltimore and Harford Counties, to H. T. Campbell & Sons, Towson, $34,054***stabilized earth paving 1.18 mi. Contr. Wi-131-1-12, Federal Aid Project NRS 345-A, Wicomico Co., to Waller Paving Co., Salisbury, $9,658. Grand total $68,475. **P.W.A.** Bids Oct. 9. Noted Oct. 4.

Massachusetts—Commonwealth of Massachusetts, Dpt. P. Wks., F. E. Lyman, comr., 100 Nashua St., Boston, tar gravel surfacing 30,-790 ft. P.W.A. Docket 5037, State Project R-49, Charlton, Sturbridge and East Brookfield, to A. L. Perini, 407 Union Ave., Framingham, $43,623. **P.W.A.** Bids Oct. 23.

Michigan—State Hy. Comn., Lansing, grading, shaping, drainage, 2 course gravel surfacing 2.945 mi. N.R.S. 54-24c-2, Mecosta Co., to John Baker & Son, Kalamazoo, $76,011*** grading, shaping, drainage structures, concrete paving 3.013 mi. NRH 58-25C-2, Monroe Co., to C. A. Handeyside Constr. Co., 11-169 General Motors Bldg., Detroit, $142,056***grading, shaping, drainage, concrete paving 4.748 mi. NRH 55-22C-1, Menominee Co., to Bacco Constr. Co., Iron Mountain, $197,236***grading, shaping sidewalks area and constructing concrete sidewalks, 0.427 mi. N.R.M. 25-21C-5, Genesee Co., to State Road Builders Inc., Grand Rapids, $3,767. Grand total $419,070. **P.W.A.** Bids Nov. 2.

Minnesota—State Hy. Comn., St. Paul, grading 9 mi. State Project 6-34-26-3, NRH 368-F, and S.P. 6-34-26-2A, NRH 368-G, and graveling 14.6 mi. S.P. 6-61-24-1 and 2, NRS 453 A and B, to Megarry Bros., Bain, $64,903 and $14,-023 respectively***grading 2.8 mi. State Project 52-153-22, NRH and M 28-A, to Strom Constr. Co., Moorhead, $28,045***graveling 8.6 mi. S.P. 67-67-21-3, NRS 459-A, to P. C. Roth, Brainard, $14,687. Grand total $121,658. **P.W.A.** Bids Nov. 2. Noted Oct. 25.

Missouri—State Hy. Dpt., Jefferson City, to Edmondson & Doty, Cassville, gravel in stockpiles, New Madrid Co., $1,901; in Stoddard Co., $1,214***to Rouses Constr. Co., Cape Girardeau, Route 55-Route N. Sect. M11, $1,535; Morley West, Sect. M11, $1,381, both Scott Co.; Anniston-Wolf Island Rd., Sect. M3, $2,304; Route SV, South, Sect. M11, $1,293, both Mississippi Co.***to Kiefner & Geile Constr. Co., Perryville, on Lutsville North Rd., Sect. M2A, $4,851; Sect. M2B, same road, $1,716; Lutsville Rd. S., Sect. M3A, $2,574; same road, Sect. M3B, $1,-276; Route 91-Stoddard Co. Rd., Sect. M4, $6,160; Sect. M1, same road, $244, all foregoing Bollinger Co.***to E. L. Markham, Cape Girardeau, Mississippi Co., $1,458; Stoddard Co., $792***to N. Davis & E. F. DeLancy, Holcomb, in Dunklin Co., $898; on Risco Rd. W., $2,327; on Gideon-Route T Rd., $484; on Risco Parmo Rd., $1,617, all foregoing New Madrid Co.***to Tobin Quarries, Inc., 220 West 39th St., Kansas City, in New Madrid Co., $1,293; Butler Co., $2,482; Pemiscot Co., $592; gravel surfacing 4.211 mi. Loose Creek-Bonnetts Mills Rd., Sect. M11A, $2,779; 2.1 mi. Sect. M11B, same road, $1,390***to C. E. Rich & Co., Troy, 4.545 mi. Route 61-Elsberg Rd., Sect. 396A1, $6,181; 3.944 mi. same road, Sect. 396-B1, $5,363; 2.164 mi. same road, Sect. 396C1, $3,000***to E. W. Jewett, Shelbina, 3.997 mi. Lakenan Rd. N., Sect. 402A1, $6,085; 3.86 mi. Sect. 402B1, same road, $4,330*** to Lay Constr. Co., North Kansas City, and Henderson Constr. Co., Richmond, 2.589 mi. Route 169-Route H, $17,119; 3.182 mi. Sect. 514A, same road, $29,211, both Gentry Co. ***to Stephens & Orender, California, 7.768 mi. Douglas Co., $3,108***to Nyer Constr. Co., Billings, 4.609 mi. Shannon Co., $35,290*** to L. L. Sharp, Springfield, 3.753 mi. Green Co., $13,772***to Joyce Logan Co., Kansas City, 5.9 mi. Boone Co., $4,518***to F. T. O'Dell Constr. Co., Hannibal, 1.636 mi. Franklin Co., $5,802***to Chaney & Amyx, Springfield, 3.934 mi. Doniphan-Pratt Rd., Sect. 2A, $2,026; 3.961 mi. Sect. 1A, same road, $2,052, both Ripley Co.***to R. R. Riney Gravel Co., Hannibal, 0.611 mi. Catawissa-Pacific Rd., Sect. 2A, $803; 1.402 mi. Sect. 1A, same road, $1,700; 1.314 mi. Sect. 2A, same road, $1,678***to J. A. Kerr, Ozark, 4.15 mi. Taney Co., $1,763; 3.643 mi. Brooklyn-Route B Rd., $2,840; 4.021 mi. Sect. 3A, same road, $3,043, both Greene

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Co.***to A. L. Cook, Ottawa, Kan., crushed stone or graveling 2.5 mi. Ralls Co., $213; 3.929 mi. Route 4-Gilman City Rd., Sect. 393A1, $7,814; 3.977 mi. Sect. 393B1, $7,935; 4.448 mi. Sect. 393C1, $7,814, all foregoing Harrison Co.; 11 mi. Parris Perry Rd., Sect. M2, $939; 4.9 mi. Sect. M1, same road, $279, both Monroe Co.***to F. M. Clark, Savannah, 3.787 mi. Sect. 496A, same road, $19,833; 3.963 mi. Sect. 496B, same road, $35,229, both Holt Co.; 0.648 mi. Chillicothe Northwest Rd., Livingston Co., $28,193***to Skrainka Constr. Co., Security Bldg., St. Louis, graveling 3.5 mi. Butler Co., $2,119; 2.9 mi. Naylor-Nellyville Rd., $1,705; gravel in stock piles on Doniphan-Route E Rd., $713, both Ripley Co.; Cardwell-Buchda Rd., $1,265; on Senath-Orts Rd., $502; Sect. M11, same road, $502; all foregoing Dunklin Co.; Deering-Route J Rd., $1,287; Route 61 Rd. W., $990; Holland-Carter Rd., $990, all foregoing Pemiscot Co.***to O. W. Knutson, Kansas City, grading 0.48 mi. Bates Co., $63,-314***to J. L. Pohl, Nevada, 4.96 mi. Napoleon-Bates City Rd., Sect. 1, $21,497; 4.992 mi. Sect. 2, same road, $9,986, both Lafayette Co.; 4.204 mi. Boone Co., $1,826; 3.698 mi. Lamonte Rd. N., Sect. 1A, $6,702; 4.895 mi. Sect. 2A, same road, $8,525***to J. Spitcaufsky, Kansas City, 4.545 mi. St. Clair Co., $20,-671; 1.681 mi. Johnson Co., $8,740; 3.037 mi. Charlton Co., $10,422; 5 mi. Route 52-Green Ridge Rd., Sect. 4A, $1,934; 2.324 mi Sect. 5A, same road, $898, both Pettis Co.***to P. McGlone, City Bank Bldg., Kansas City, 2.24 mi. Louisiana-Clarksville Rd., Sect. 487A, $39,-613; 4.716 mi. Sect. 487B, same road, $60,-865; 2.673 mi. Sect. 487C, same road, $38,-199***to R. E. Brown, Cape Girardeau, Route J-Cape Girardeau Rd., Sect. 500A, Cape Girardeau Co., $17,298; 5 mi. Bloomfield Rd. W., Sect. 504, Stoddard Co., $19,433***to List & Clark, Kansas City, 2.85 mi. Hemple-Route 33 Rd., $11,962; 3.208 mi. Sect. 493B, same road, $9,155, both Clinton Co.; 3.541 mi. Morehouse-Lilbourne Rd., Sect. 508A, $4,789; 3.783 mi. Sect. 508B, same road, $10,117, both New Madrid Co.***to Davis Constr. Co., Booneville, 1.36 mi. Pacific-Bourbouse River Rd., Sect. 509A, $108,073; 1.36 mi. Sect. 509B, same road, $31,694, both Franklin Co.; 2.84 mi. Augusta Warren Co. Rd., Sect. 5, $12,802; 2.626 mi. Sect. 6, same road, $10,196***to Webb Boone Paving Co., 5102 Fyler St., St. Louis, $1,86 mi. Oakland Ave., $186,238; 0.359 mi. Kings Highway, $206,917, both St. Louis Co.***lo M. E. Gillioz, concrete paving 0.237 mi. Poplar Bluff West Rd., Sect. 207E, $12,861; 0.907 mi. Sect. 207A, same road, $42,852; 0.434 mi. Route 67-Poplar Bluffs Rd., $21,025; 2.772 mi. Poplar Bluff-Northeast Rd., $109,172; 0.578 mi. Sect. 58A, in Poplar Bluff, $23,017; 1.502 mi. Poplar Bluff-Southwest Rd., $68,787, all foregoing Butler Co. Grand total $1,510,147. Rejected bids improving roads in New Madrid, Cape Girardeau, Stoddard and Butler Counties. Bids Nov. 2.

†New Mexico—Pub. Rds., Denver, Colo., grading 2.58 mi. and base course surfacing 7.633 mi. road in Catron Co., to Dudley Stone Products Co., 2010 San Diego St., El Paso, Tex., $88,727. Bids Oct. 22, awarded Nov. 6.

New Mexico—State Hy. Dpt., Santa Fe, improving roads in Sante Fe and Torrance Counties, to Skousen Bros., Albuquerque, $47,132 est. $69,979; in Taos Co., to Capitol Constr. Co., Sante Fe, $19,329 est. $10,000. **P.W.A.** Bids Nov. 5.

N. Y., Mayville—Chautauqua Co., bituminous macadam paving 4.45 mi. Rd. 99; 4.46 mi. Rd. 100; 5.48 mi. Rd. 315 and 3.76 mi. Rd. 318, day labor. To exceed $25,000. **Maturity 1935.** E. Fitch, Falconer, engr.

N. Y., Ossining—City, street improvements, Contr. 2, Stormytown Rd., to A. E. Ottaviano, Inc., Croton-on-Hudson, $26,096. **P.W.A.**

North Carolina—State Hy. Dpt. and P. Wks., Raleigh, bituminous surface treating 0.83 mi. hy. between Beaufort and Atlantic Rd., Project 2033, Carteret Co., to Goodwin & Huffines, Raleigh, $3,980***bituminous concrete surfacing 0.24 mi. hy. Goldsboro, Project 2800, Wayne Co., and concrete paving 0.13 mi. hy. Lincoln, Project 6481, Lincoln Co., to Brown Paving Co., Lexington, $6,356 and $7,489 respectively***grading, crusher run stone paving 6.98 mi. hy. Newton, toward intersection Route 17, Project 6290, Catawba Co., to N. L. Teer, Durham, $69,582***grading, topsoiling, crusher run stone paving 11.65 mi. Project 6410, Iredell Co., to E. W. Grannis, Fayetteville, $74,484. Grand total $161,891. Bids Nov. 7. Noted Nov. 1.

Ohio—O. W. Merrell, dir. Hys., Columbus, brick paving, incl. furnishing, delivering brick, landscaping both sides of hy., removing old concrete wearing surface, waterproofing expansion joints, excavating channel, placing rip rap and placing wearing surface on bridge 1.602 mi. Sects. "D-2" and "K-2" (part) Logan-Athens Rd., Athens Co., to F. H. Beckler, Athens, $91,470; concrete paving 2.042 mi. Sects. "S" and "U" (part) Ohio River Rd., Monroe and Washington Counties, to L. T. Cisler & Son, and Merry & Cisler, Marietta, $62,-942. Bids Nov. 9. Noted Nov. 1.

Ohio—O. W. Merrell, dir. Hys., Columbus, building 40 ft. road embankment, constructing drainage structures, traffic bound surface course paving 1.174 mi. Sect. "A" (part) Waverly-Coopersville Rd., Pike Co., to W. L. Johnson Constr. Co., Hicksville, $167,893. Bids Nov. 2. Noted Oct. 25.

Oklahoma—State Hy. Comn., Oklahoma City grading, drainage 5.71 mi. road in Adair Co., to F. B. Richards, Insurance Bldg., Oklahoma City $43,765 est. $47,380***5.41 mi. NRH 217E and 4.91 mi. NRH 217A, Garvin Co., to Merveldt & Lawson, El Reno, $15,492 and $13,245 respectively est. $17,200 and $16,000 respectively***asphalt topping 0.3 mi. NRH 216 Kiowa Co., to Western Paving Co., 519½ West Main St., Oklahoma City, $5,071 est. $5,349. Grand total $77,573. **P.W.A.** Bids Nov. 7. Noted Nov. 1.

†Oregon—Pub. Rds., Post Office Bldg., Portland, grading 2.5 mi. Crater Lake Natl. Park Rim West, Crater Lake Natl. Park, to Vonder Hellen & Pierson, Medford, $140,356. Bids Oct. 12. Noted Oct. 4.

†Oregon—Pub. Rds., grading, culverts, Crater Lake Natl. Park, Klamath Co., to Dunn & Baker, Klamath Falls, $112,915. Est. $112,-915. Awarded Nov. 14.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, dual type paving consisting of two lanes and one 10 ft. bit. surface course Spec. "E" on broken stone base center lane, also rein.-con. paving 2.39 mi. Route 157, Sect. 7, Richmond and Maxatawny Twps., Berks Co., and rein.-con. paving 2.29 mi. Route 166, Sect. 7, Easton, Forks Twp., Northampton Co., to Wm. Eisenberg & Sons, Inc., 18th and Pierce Sts., Camden, N. J., $126,929 and $98,399 respectively***grading, rein.-con. arch on 0.55 mi. Route 29, Sect. 2, Potter Twp., Center Co., to F. D. Kessler, Northumberland, $55,086. Grand total $280,-414. **P.W.A.** Bids Oct. 26. Noted Oct. 18.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, bit. penetration macadam on native stone or modified stone paving 3.95 mi. Route 383, Sect. 1, Curtis Twp., Blair Co., to N. B. Putnam, 204 Transfer St., Fort Wayne, Ind., $114,167***bituminous penetration, native stone base paving 2.83 mi. Route 49015, Coal and Mt. Carmel Twps., Northumberland Co., to Shively & Snyder, Herndon, $64,760*** rein.-con. paving 1.77 mi. Route 88, Sect. 5, Wayne Twp., Erie Co., to Charles H. Fry Constr. Co., 1902 Cherry St., Erie, $60,801*** bit. penetration surface PM 2 on native stone paving also 1 steel stringer bridge on 1.07 mi. Route 36870 Brecknock Twp., Lancaster Co., to J. Miller Eshleman, Landisville, $19,721. Grand total $259,449. **P.W.A.** Bids Nov. 2. Noted Oct. 25.

Pennsylvania—At office S. S. Lewis, secy. Hys., Harrisburg, rein.-con. paving 3.22 mi. Route 52, Sect. R-4, East Taylor and Jackson Twps., and 3.08 mi. Route 52, Sect. R-5, Jackson Twp., both Cambria Co., to S. T. Brotmarkle Constr. Co., 3116 Brownsville Rd., Pittsburgh, $153,387 and $154,151 respectively*** rein.-con. paving 3.38 mi. Route 73, Sect. 3, Mercer Boro, Findlay Twp., Mercer Co., to General Asphalt Paving Co., 307 Kahler Bldg., Canton, O., $110,475. Grand total $419,013. **P.W.A.** Bids Oct. 19. Noted Oct. 11.

Pa., Parkside—Borough, 6 in. concrete curbing, cement-bound macadam paving 29,479 sq. yd. various streets, to Pennsylvania Paving Co., Law Bldg., Chester, $68,879. **P.W.A.**

Rhode Island—State Bd. P. Roads, Providence, sheet asphalt on concrete paving 1.36 mi. Hope St., Contr. 3410, NRH 80-B, Bristol, to M. A. Gammino Constr. Co., 728 Valley St., Providence, $80,550***0.9 mi. Contr. 3411, Bullocks Point Ave., Providence, to Lane Constr. Co., 37 Colony St., Meriden, Conn., $70,-977***bituminous macadam penetration paving 2.41 mi. Kingston Rd., Richmond, Contr. 3412, NRH 35-47-B to A. Susi & Co., 68 Cedrus St., Roslindale, $61,635. Grand total $213,162. **P.W.A.** Bids Nov. 2, awarded Nov. 9.

Rhode Island—State Bd. P. Roads, Providence, penetration bituminous macadam paving 4.32 mi. NRH 86, Contr. 3413, Westerly, to Lawton Constr. Co., 79 Lenox Ave., Providence, $130,495. **P.W.A.** Bids Nov. 2.

†S. C., Parris Island—Pub. Wks. Officer, Marine Barracks, concrete and bituminous macadam paving, drainage system at Marine Barracks, to Simons-Mayrant Constr. Co., Charleston, $40,000. Bids Nov. 12.

South Dakota—State Hy. Comn., Pierre, to England & England, Murdo, grading 7.885 mi. Walworth Co., $36,220***to Dowd Bros., Inc., Clark, 6.099 mi. Spink Co., $17,271***to Summit Constr. Co., Summit, gravel base course on 4.291 mi. Clark Co., $6,244 graveling 6.039 mi. McPherson Co., $5,199; 8.208 mi. Clark Co., $5,062***to C. A. Wagner Constr. Co., Sioux Falls, gravel base course on 13.285 mi. Hutchinson Co., $17,980; graveling 10.167 mi. Roberts Co., $13,597***to National Constr. Co., Sioux Falls, gravel base course on 9.854 mi. Sanborn Co., $19,356; graveling 10.857 mi. Dewey and Ziebach Counties, $13,502; 8.853 mi. Corson Co., $10,765***to S. S. Roberts, Rapid City, 16.896 mi. Perkins Co., $24,408; 13.918 mi. Mellette Co., $21,703; 5.102 mi. in Haakon and Stanley Counties, $7,620; resurfacing 19.801 mi. Potter and Dewey Counties, $7,607; 21.188 mi. Tripp Co., $15,110***to F. Schuknecht, Jr., Parker, graveling 5.054 mi. Spink

†*Federal Government.*

Streets and Roads (Continued)

Co., $3,696; 6.108 mi. Deuel Co., $3,342; resurfacing 10.983 mi. Deuel Co., $5,286***to B. Vander Schaaf, Hull, Ia., graveling 14.621 mi. Lincoln and Union Counties, $8,001; resurfacing 7.965 mi. Edmunds Co., $3,535***to Inland Constr. Co., Grain Exch. Bldg., Omaha, Neb., graveling 6.037 mi. Butte Co., $12,998. Grand total $258,502. **P.W.A.** Bids Nov. 8. Noted Nov. 1.

†Wyoming—Pub. Rds., Denver, Colo., grading, surfacing 2.943 mi. road in Lincoln Co., to O. Nelson, Logan, Utah, $69,960. Bids Oct. 22.

Ont., Toronto—East York Twp. relief work to be carried out under supervision of Twp. Engineer, grading Samman and St. Clair Aves. $50,000, improving Cosburn, Woodbine and Todmorden Parks $22,000, miscellaneous improvements $8,000, filling Nissre Ave. $30,000. Labor $110,000, materials $10,000.

Ont., Toronto—City, to Kilmer, Gibson & Van Nostrand, Fleet St., asphalt paving, widening and replacement Queen's Park from Highlander's Monument to Bloor St. W., $24,401 ***to Standard Paving & Materials Ltd., Harbor Comn. Bldg., asphalt paving, widening and replacement Broadview Ave. from Eastern Ave. to Queen St., $24,579***to Rayner Constr. Co. Ltd., 29 Commercial St., asphalt paving replacement Carlton St. from Church to Parliament Sts., Contr. A, 124 ft. east of Church St. to 300 ft. east of Jarvis St., $15,606; asphalt paving replacement, widening, Contr. A, Shuter St., from Victoria to Church Sts., $14,247; Contr. B, Church St. to east line of Jarvis St., $16,970***to Warren Bituminous Paving Co. Ltd., 388 University Ave., Contr. C, east line of Jarvis St. to Sherbourne St., $25,896 ***to Constructing & Paving Co. Ltd., Fleet St. W., Carlton St. from Church St. to Parliament Sts., Contr. B, 300 ft. east of Jarvis to Seaton St. line, $18,472***to Godson Contg. Co. Ltd., 203 Richmond St. W., Contr. C, Seaton St. line to Parliament St., $15,868***to Comm. of Wks., Toronto, concrete walks and curbs on Adelaide St. E., $4.17 per lin.ft.; Cherry St. west side, $4.57; Front St., north side, $2.65; Market St. east side, $3.37; Parkside Dr., east side, $2.67; concrete walks on Beaver Ave., south side, 25c. per lin.ft.; Connolly St., south side, 23c.; Glenlake Ave., north side, 23c.; Keele St., east side, 23c.; Lympstone Ave. S., 25c.; Mt. Pleasant Rd., east, 30c.; Mountview Ave., east, 23c.; Strachan Ave., west and east sides, 28c.; concrete curbing on Strachan Ave., both sides, at $2.25 per lin.ft. ***to Grant Contg. Co. Ltd., 47 Wellington St. E., concrete walks and curbs on Dundas St. W., south side, at $2.25 per lin.ft.; Rascharo St. E., on east and south sides, $2; Fernbank Ave., south side, 23c.; Southview Ave., north side, 23c***to L. P. Acri, 28 Grove Ave., Queen St. W., subway south side at $3.80 per lin.ft.; concrete walks on Gladstone Ave., east side, at 24.9c. per lin.ft.; Winchester St., south side, at 24.9c.***to L. Paci, 317 Manning Ave., Barton Ave., south side, at 24c. per lin.ft.***to E. Mark, 1398 Davenport Rd., Caledonia Rd., east side, 24c.; Chatham Ave., south side, 24c.***to J. Dileo, 239 Bellwoods Ave., Connolly St., north side, 22c. per lin.ft. ***to P. Del Greco, 68 Montcalm Ave., Gladstone Ave., west side, 24.5c. per lin.ft. Bids Oct. 29.

EARTHWORK, IRRIGATION DRAINAGE AND WATERWAYS

PROPOSED WORK

La., West Monroe—Drainage Bd., S. H. Humphreys, pres., plans constructing pumping plant and drainage system. P.W.A. allotted $74,000 loan and grant. Noted Dec. 14.

Neb., Columbus—Loup River Public Power Dist. making plans 2 electric power plant, 66 kv. and 110 kv.; 175 mi. power transmission lines, steel towers; 2 rein.-con. dams, 1,100 ft. long 10 ft. high. Harza Mfg. Co., 205 West Wacker Dr., Chicago, Ill., engrs. Noted Oct. 18.

Tex., Brownsville—Rio Grande Valley Conservation & Reclamation Dist., c/o Judge A. W. Cunningham, revised plans to be submitted to Federal Govt. this month for construction of 200 mi. drain canals and laterals through Hidalgo, Willacy and Starr Counties, $2,000,000. E. M. Card, 1310 Chicago St., McAllen, W. G. Johnson, Raymondville, and R. Agar, 711 North Sam Houston St., San Benito, consult. engrs.

Tex., Freeport—Brazos River Harbor Navigation Dist., c/o E. C. Toby, chn., Freeport, soon takes bids constructing harbor facilities, incl. wharf with transit shed, 2 large fireproof warehouses, trackage and roads. $550,000. P.W.A. project. R. J. Cummins, Bankers Mortgage Bldg., Houston, engr. Noted Mar. 8.

Tex., Rusk—Texas Reclamation Eng. Dpt. and Smith Co. Eng. Dpt., plan topographical survey of Mud Creek Basin and other points with object restoring a large area of land to use and eliminating stagnant pools of water. $500,000.

Ont., Port Arthur—See "Bridges and Grade Crossings."

†Federal Government.

Ont., Toronto—City Council plans constructing seawall from Strachan Ave. to Bathurst St. $112,000.

Ont., Toronto—Toronto Harbor Comn., Harbor Comn. Bldg., voted $350,000 for reclamation work as City's share of work to be done 1934-1935 in conjunction with Dominion Govt. $766,000.

BIDS ASKED

Calif., Ventura—Dec. 7, by Clerk Ventura Co., Court House, constructing 1,800 lin.ft. steel angle iron jetty for protection work on Santa Clara River. To exceed $17,750. Mr. Peter, Ventura, co. surv. L. E. Hallowell, co. clk.

†Colorado—Feb. 18, by Bureau Reclamation, Gunnison, constructing Taylor Park Dam, Uncompahgre Project, Alternate 1 concrete arch dam, incl. 61,000 cu.yd. common open cut and 28,500 cu.yd. rock or open cut excav., 4,000 cu.yd. back fill, 1,400 cu.yd. rubble masonry, 100,000 cu.yd. concrete, 13,000 cu.ft. grout, or alternate 2 earth and rock fill dam, incl. 95,000 cu.yd. excav. in open cut, 63,000 cu.yd. rock excav., open cut, 853,000 cu.yd. common and 35,000 cu.yd. loose rock borrow pit excav., 6,000 cu.yd. tunnel excav., 825,000 cu.yd. earthfill embankment, 26,000 cu.yd. rip rap on upstream slope of embankment, 2,500 cu.yd. concrete in tunnel and gate chambers, 7,300 cu.yd. concrete in other parts of dam, 7,000 cu.ft. pressure grouting. Noted July 26.

†Louisiana—Nov. 30, by U. S. Eng., Prytania St. and River Front, 154,000 cu.yd. drainage canals above Bonnet Carre Spillway Upper Guide Levee.

†Louisiana—Dec. 4, by U. S. Eng., Prytania St. and River Front, New Orleans, 360,000 cu.yd. Item W 28-A, Palmetto-Courtableau Levee, West Atchafalaya Basin Projection Levee; 380,000 cu.yd. Item W 28-B, same levee; and 420,000 cu.yd. Item W 28-C, same levee.

†Mississippi—Nov. 26, by U. S. Eng., P. O. Box 97, Memphis, Tenn., placing concrete cap and apron around and over the end of spur levee in Upper Yazoo Levee Dist., 2 mi. southwest of Friar Point.

Nebraska—Dec. 5, by Platte Valley Power & Irrigation Dist., North Platte, constructing Sects. A and B, supply canal between Diversion Dam and Sutherland Reservoir of Sutherland Project, Keith Co., Proposals (1) 2,900,000 cu. yd. earth excav. and 100,000 cu.yd. rolled embankment (2) 9,300 cu.yd. reinforced concrete structure and canal lining (3) 213,000 F.B.M. bridge lumber (4) 500 tons reinforcing steel with alternate 450,000 sq.ft. gunite canal lining. Dec. 4, furnishing 2 vertical shaft Francis turbines and governors of actuating type to be delivered at Union Pacific R.R. station, North Platte. D. D. Price, North Platte, ch. engr.

†O., Gallipolis—Dec. 6 (extended date) by U. S. Eng., Huntington, W. Va., constructing dam and appurtenant work at Gallipolis Lock and Dam, near here. Noted Nov. 15.

†Oregon-Idaho—Dec. 4, by Bureau Reclamation, Ontario, Ore., constructing earthwork and structures, Coyote Gulch Drain, Dead Ox Flat Division, Owyhee Project, Oregon-Idaho, incl. 115,000 cu.yd. excav. for drain, 260 cu.yd. excav. for structures, etc.

†Texas—Dec. 14, by U. S. Eng., Trust Bldg., Galveston, dredging 819,500 cu.yd. material from Brazos Island Harbor, incl. channel from inside Brazos Santiago Pass to west of Long Island, thence to and incl. turning basin at Point Isabel.

†Utah—Feb. 4, by Bureau Reclamation, Salt Lake City, constructing Moon Lake Dam, Moon Lake Project, near Duchesne, incl. 116,000 cu. yd. common open cut excav., 394,000 cu.yd. common excav. from borrow pits, 17,000 cu.yd. rock open cut excav., 32,000 cu.yd. rock excav. from borrow pits, 700 cu.yd. stoped excav., 12,400 cu.yd. tunnel excav., 6,000 cu.yd. backfill about structures, 400,000 cu.yd. earthfill in embankment, 200 cu.yd. screened gravel under structures, 3,900 cu.yd. concrete in tunnels and gate chamber, 4,000 cu.yd. concrete in spillway intake, parapet and other structures, 1,350 cu.yd. concrete paving, 1,000 cu. ft. pressure grouting, 90,000 lb. steel tunnel liner plates, 175,000 cu.yd. gates and other metal work, 870,000 lb. reinforcement bars, 740 lin.ft. electrical metal conduit, Spec. 605.

†Va., Norfolk—Dec. 3, by Yards & Docks, Navy Dpt., Wash., D. C., dredging and disposing of dredge material at Naval Operating Base, Spec. 7802.

†Washington—Dec. 6, by Bureau Reclamation, Dpt. Interior, Almira, constructing highway, street, alley, and parking area, surfacing, sidewalks, curbs, gutters, catchbasins, and storm sewers for Government Camp, at Grand Coulee Dam, Columbia Basin Project, about 22 mi. northwest of Almira.

LOW BIDDERS

†Calif., Newport—U. S. Eng., Los Angeles, dredging Newport Harbor, from Standard Dredging Co., Central Bldg., Los Angeles, $1,122,634.

Ill., East St. Louis—Bd. Trustees East Side Levee & Sanitary Dist., 728A Missouri Ave., Nov. 2, constructing diversion channel for Cahokia Creek, near National Stock Yards, from G. Locke Tarlton, 411 North 7th St., St. Louis, Mo., $2,259,500. Est. $2,360,000. **P.W.A.** project. Noted Sept. 27.

CONTRACTS AWARDED

Ark., West Memphis—Bd. Directors St. Francis Levee Dist., cancelled letting scheduled for Nov. 1, constructing complete drainage ditches, 26 corrugated iron culverts, headwalls along levee and through embankment of Rock Island R.R., east of Hulbert Levee, Levee Miles 152 and 153. Entire letting and execution of work will be done by Rock Island Ry., c/o R. H. Ford, asst. ch. engr., La Salle St. Sta., Chicago, Ill. H. N. Pharr, West Memphis, ch. engr. of Dist. Noted Oct. 25.

†California—U. S. Eng., Post Office Bldg., Sacramento, 7,800 tons Class A or B rip-rap stone on banks Sacramento River, vicinity Chicery and Oak Hill Bends, near Sacramento, to Basalt Rock Co., 900 8th St., Napa, $18,720. Bids Oct. 15.

†California—U. S. Eng., Post Office Bldg., Sacramento, raising, strengthening 3,850 ft. existing levee on east side of Sacramento River between Colusa and Butte Slough, to D. McDonald, 204 23rd St., Sacramento, at 28c. per cu.yd., total $22,960. Bids Oct. 11.

Calif., Los Angeles—Bd. Supervs. Flood Control Dist., 205 South Bway., J. M. Fisher, engr., placing 59,500 cu.yd. loose rock fill downstream face San Gabriel Dam 2, 3,000 cu.yd. place packed rock fill on crest, 62,000 cu.yd. place waste in waste piles, to Macco Constr. Co., Clearwater, $124,075. Bids Nov. 5, awarded Nov. 14. Noted Nov. 15.

†Calif., Meridian—U. S. Eng., Post Office Bldg., constructing Tisdale Weir abutments, Spec. 6707, to M. A. Jenkins, 3560 Y St., Sacramento, $4,413. Bids Nov. 12, awarded Nov. 12.

†Florida—U. S. Eng., Jacksonville, constructing 1,737,000 cu.yd. levee work along east shore Lake Okeechobee, to Spadaro Constr. Co., Moores Haven, $364,700. Bids Oct. 24; 7,964,200 cu.yd. on east shore, same lake, to Arundel Corp., 2 Pratt St., Baltimore, Md., $1,782,270. Bids Oct. 26. Noted Oct. 18.

Ill., Hillview—Hartwell Drainage & Levee Dist., C. Arnold, secy., 211 East St., rehabilitation of pumping station in back of Hartwell Drainage & Levee Dist., to S. G. Chumley-F. H. Foote, 405 North Sandy St., Jacksonville, $35,600. Bids Oct. 25. (**Correction**—Contractor's address). Noted Nov. 15, under "Contracts Awarded."

Miss., Corinth—Hatchie Drainage Dist., Alcorn and Tippah Counties, c/o E. B. Mitchell, atty.-at-law, clearing all obstructions from canal for distance of 6 mi., involving removing 65,000 cu.yd. earth, to J. T. Crow & Son, Corinth, at 15c. per cu.yd. Bids Oct. 22. Noted Oct. 25.

†Montana—U. S. Eng., Kansas City, Mo., constructing spillway for Fort Peck Dam, to Massman Constr. Co., 737 New York Life Bldg., Kansas City, Mo., $7,133,055. Est. $6,000,000. Bids Nov. 12, awarded Nov. 12. Noted Nov. 1.

Nebraska—Loup River Public Power Dist., C. B. Fricke, pres., Columbus, completing canal excavation and earthwork, incl. 3,300,000 cu.yd. excav. in Platte River in vicinity of Columbus, to Martin Day Co., Little Bldg., Lincoln, $260,920. **P.W.A.** Bids Nov. 9. Noted Nov. 1.

Nebraska—Platte Valley Power & Irrigation Dist., North Platte, canal excavation and earthwork, to W. S. Hardwick Constr. Co., Memphis, Tenn., $167,840. **P.W.A.** Bids Oct. 19. Noted Oct. 11.

Neb., Omaha—Douglas Co. constructing earthwork dam across valley impounding 30 acres land, the dam and reservoir will prevent floods and conserve water, near here, by FERA labor, $20,000 or more. Will start surveying at once.

Tex., Orange—Orange Co. Conservation & Reclamation Dist., c/o C. C. Leddy, agt., drainage work, involving 3,678,415 cu.yd. excav., to Sternberg Dredging Co., Arcade Bldg., St. Louis, Mo., $546,244. **P.W.A.** Bids Oct. 29. Noted Oct. 19.

Tex., Palacios—Palacios Seawall Comn., c/o G. A. Harrison, chn., seawall repairs, pavilion, bathhouse, pier on protecting breakwater, to Southwestern Constr. Co., 3802 Calhoun St., Houston, $155,595. **P.W.A.**

Man., Red River—Dpt. Marine, Ottawa, Ont., constructing lock gates at St. Andrew lock, to Carter, Halls, Aldinger Ltd., Winnipeg, $24,124.

FEDERAL POWER COMMISSION

Applications for Licenses and Permits Licenses

1290—Kanawha Valley Power Co., Charleston, W. Va., wants license power project at proposed United States Dam 1 (Winfield Dam) on Kanawha River, Putnam and Kanawha Counties.

1291—W. W. McLaughlin, Comptonville, Calif., wants license power project on Cherokee Creek, a tributary of North Fork of Yuba River, Sierra Co.

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Earthwork, etc. (Continued)

1292—Puget Sound Power & Light Co., 7th and Olive Sts., Seattle, Wash., and Boston, Mass., wants license constructed transmission line in Kittitas Co., Wash., affecting lands in Wenatchee Natl. Forest.

UNCLASSIFIED

PROPOSED WORK

California—NATURAL GAS PIPE SYSTEM—City Councils of cities of Tulare, Porterville, Hanford and Lindsay have voted to enter a utilities district for supplying natural gas by 90 mi. pipe line from Kettleman Hills and Dudley Ridge Oil Fields to their respective communities and also to Visalia, Exeter and Lemoore. $920,000. Requirements would be probably 4 to 5 million cu.ft. of gas per day. Financing to be from bond issues to be voted in each of interested cities.

Calif., Willows—ELECTRIC DISTRIBUTING SYSTEM—Proposal to form district to finance purchase of electric distributing system, failed at recent election.

Ind., Linton—GAS DISTRIBUTION SYSTEM—Municipality plans 7 mi. gas distribution system. $83,000. Will apply for P.W.A. loan.

Ia., Macedonia—ELECTRIC SYSTEM—Election Dec. 4, on granting franchise to Iowa-Nebraska Light & Power Co., to construct, maintain and operate electric light and power system.

Kan., Atchison—PLAYGROUNDS—City, Bd. Educ. voted $34,000 for school playgrounds.

Kan., Pittsburg — SWIMMING POOL — City, L. Boyd, clk., defeated $50,000 bonds, swimming pool. B. F. Churchill, Iola, engr.

Kentucky—GAS PIPE LINE—Warfield Natural Gas Co., Prestonburg, plans 16 mi. 12 in. steel gas pipe line from Clear Creek to Knott County.

Ky., Fort Thomas—PLAYGROUND, etc.—Dpt. Parks, c/o Municipality, plans playground and park improvements. $95,000.

Michigan—GAS PIPE LINE—Muskegon Gas Co., Muskegon, and E. Eimer, mayor, North Muskegon, plan gas pipe line extension from Muskegon to North Muskegon. To exceed $40,000. **Maturity indefinite.**

Missouri—RAILROAD—Federal Trustees of Missouri Pacific R.R. Co., S. L. Wonson, asst. ch. engr., Missouri Pacific Bldg., St. Louis, have been authorized by U. S. Dist. Judge Charles B. Garis to spend $60,010 for trackage additions and loading facilities for Lower Rio Grande R.R.

Mo., Carthage—PARK—City, K. E. Baker, mayor, soon takes bids improving park, incl. swimming pool, bathhouse, driveway, walks, etc. $71,326. P.W.A. project. E. S. Glenn, city engr. Hare & Hare, 114 West 10th St., Kansas City, consult. engrs. Noted Nov. 8.

Nebraska—ELECTRIC DISTRIBUTION SYSTEM—Southeast Nebraska Power Dist., Beatrice, J. E. Fisher, secy., soon takes bids 600 mi. rural electric lines for distribution system, in southeast part of the state, mostly in Gage Co. $575,000. L. C. Black, Beatrice, resident engr.

N. Y., New York—SHELTER and RECREATION BUILDING—Dpt. Parks, Arsenal Bldg., Central Park, plans by A. Embury, c/o owner, 2 story, basement, brick, concrete shelter and recreation building, 9 Downing St. $28,000.

N. C., Fayetteville — SWIMMING POOL — City making plans 210x310 ft. concrete swimming pool on city waterworks property. $150,000. P.W.A. project. W. S. Olsen, Raleigh, consult. engr. A. E. Dixon, Fayetteville, chn. city P. Wks. Comm. Will file application with P.W.A. for funds to finance same.

O., Dayton — SWIMMING POOL — E. S. Reynolds, Alexandersville Rd., plans by E. A. Hart, 1244 Demphle Ave., 35x70 ft., rein.-con. swimming pool, Alexandersville Rd. To exceed $18,000.

Pa., Bellevue—SWIMMING POOL—Municipality voted $60,000 for municipal swimming pool.

Pa., Erie—AIRPORT—Peninsula Park Comn., 1210 Erie Trust Bldg., cancelled plans for construction of airport at Peninsula Park, F. Talbot, c/o owner, engr. Noted Oct. 25.

Pa., New Castle—TUNNEL—City and Lawrence Co., abandoned plans for construction vehicular tunnel from Grant St. through North Hill to White's Hollow. $1,000,000. G. H. Hoskins, city engr. Noted Aug. 23.

Texas—OIL PROPERTIES DEVELOPMENT—Delta Oil Co., c/o G. Kean, pres., Cooper, plans developing oil properties, incl. drilling of oil wells, various locations. To exceed $30,000.

Texas—OIL PROPERTIES DEVELOPMENT—Pure Oil Co., 35 East Wacker Dr., Chicago, Ill., plans developing oil properties, Louis Oil Fields, Wharton Co., incl. wells, storage, shops, etc. To exceed $30,000.

Utah—RAILROAD—Los Angeles & Salt Lake R.R. Co., subsidiary Union Pacific R.R. Co.,

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H. C. Mann, ch. engr., 1416 Dodge St., Omaha, Neb., plans extending 11 mi. railroad from Desert Mound to Iron Mountain to tap iron ore deposits.

B. C., New Westminster—POWER SURVEY—City plans to have consulting engineers make a survey of the power situation. At the present time the city buys its power in bulk from the British Columbia Power Corp. and distributes through its own mains.

B. C., Vancouver — ASPHALT PLANT — C. Brakenridge, city engr., preparing plans for civic asphalt plant. $70,000.

Sask., Lloydminster—GAS SYSTEM—City plans to pipe natural gas from well north of city. $75,000. **Maturity indefinite.**

BIDS ASKED

Calif., Los Angeles—TUNNELS—Dec. 17, by Bd. Directors, Metropolitan Water Dist., 306 West 3rd St., F. E. Weymouth, engr., tunnel construction, Monrovia Tunnels 1, 2 and 3 and Pasadena tunnels, all 10 ft. diam., concrete-lined, Spec. 77, in connection with Colorado River Aqueduct. To exceed $4,000,000.

†D. C., Wash.—SIGNAL SYSTEM—Nov. 30, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing signal system at Dpt. of Labor Building.

Md., Frostburg—DAM—Nov. 27, by City, constructing dam, involving 2,100 cu.yd. earth excav., 800 cu.yd. rock, 600 lin.ft. drilling, 3,055 cu.yd. concrete, 105 tons reinforcing, 7,100 lb. miscellaneous steel, 2,000 ft. expansion joints, 21 tons c.i. pipe, 2,500 cu.yd. earth embankment, sluice gates, flash boards and electric light system. P.W.A. project. Whitman, Requardt & Smith, Charles and Biddle Sts., Baltimore, engrs. Noted Oct. 25.

N. Y., Jamestown—PARK IMPROVEMENTS—See "Contracts Awarded."

Tex., Big Spring—SWIMMING POOL, etc.—City, E. B. Spence, mayor bids about Dec. 18, 60x150 ft. rein.-con. swimming pool, treatment of pool water, 1½ story, 47x70 ft., frame veneer, local field stone bathhouse, etc. $32,000. P.W.A. project. Peters, Strange & Co., Lubbock and Longview, engrs.

British Columbia—TRANSMISSION LINE—See "Contracts Awarded."

Ont., Toronto — BOARDWALK — See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Stockton—RAILROAD SYSTEM—City Port Comn., extending railroad system at Stockton Port, involving 6,000 cu.yd. excav., (grading), 2,600 lin.ft. railroad track, 2 crossing switches, to Willard & Biasotti, 40 West Clay St., $18,140. Bids Oct. 30, awarded Nov. 5.

Conn., Hartford — SWIMMING POOL — City, Dpt. Parks, 50x125 ft. swimming pool and bathhouses, at Colt Park, FERA labor. $16,500. Noted Aug. 2.

Ky., England Hill—RAILROAD WORK—Chesapeake & Ohio R.R., C. W. Johns, ch. engr., Richmond, Va., grading, drainage, and track relocation, to Boxley Bros., Orange, Va., about $80,000.

La., Shreveport—FIRE ALARM SYSTEM—City, repairs and extensions to fire alarm system, to Grover & Maples, Shreveport, $51,750. **P.W.A.** Awarded Nov. 10.

†Md., Annapolis—TOWERS—Yards & Docks, Navy Dpt., Wash., D. C., constructing lead in towers, Spec. 7834, to Victor Constr. Co., 441 Lexington Ave., New York, $10,475.

Neb., Omaha—TRAFFIC LIGHTS—City, installing traffic lights, to Sterling Electric Co., 2429 Farnam St. Other bids taken Nov. 6 rejected. F. Welty, city purchasing agent will purchase materials. Noted Nov. 8.

†New Jersey—REMOVING WRECK—U. S. Eng., Wash., D. C., removing wreck of Morro Castle, beached off Asbury Park, to Merritt, Chapman & Scott Corp., 17 Battery Pl., New York, $149,000. Bids Nov. 5.

N. J., Kearny—BULK OIL STORAGE—Independent Oil Co., 615 Riverside Ave., Lyndhurst, bulk oil storage, separate contracts awarded. Est. $28,000 with equipment. Storage tanks, to Chicago Bridge & Iron Co., 165 Bway., New York.

N. J., Lyndhurst—BULK OIL STORAGE—Independent Oil Co. of America, 615 Riverside Ave., constructing bulk oil storage, by separate contracts. $28,000 with equipment. Storage tanks awarded to Chicago Bridge & Iron Wks., 165 Bway., New York.

New York—DRAINAGE EQUIPMENT—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing drainage equipment for Lines A and B, to Woodcrest Constr. Co. Grand Central Terminal, New York, $164,400. Bids Sept. 28. Noted Sept. 13.

New York—LIGHTING EQUIPMENT—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, furnishing, installing station and tunnel lighting equipment, etc., for Bway.-Lafayette and York Street Stations, to Lord Electric Corp., 105 West 40th St., New York, $104,000. Noted Sept. 27.

N. Y., Brooklyn—BULK OIL STATION—Colonial Beacon Oil Co., 155 East 44th St., New York, bulk oil storage distribution at Whale Creek, Provost and Freeman Sts., to L. Roberts, 200 5th Ave., New York. Est. $100,000 or more.

N. Y., Jamestown—PARK IMPROVEMENTS—Dpt. P. Wks., improving and beautifying Allen Park, by day labor, under supervision of City Eng. and Dpt. P. Wks., $39,000. ERB project. L. F. Graham, city engr.

N. Y., New York—ESCALATOR EQUIPMENT—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., furnishing, installing passenger escalator equipment at East Bway. Station, to Otis Elevator Co., 11th Ave. and 26th St., $28,470. Bids Oct. 2. Noted Sept. 20.

N. Y., New York—POWER EQUIPMENT—Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., furnishing, installing power equipment for Jamaica Line of Independent System, to General Electric Co., 570 Lexington Ave., $2,688,280. Bids Aug. 7. Noted July 12 under "Materials and Equipment."

N. Y., Shackeltons Point—GREENHOUSE, etc.—C. S. Brown, 725 Water St., Syracuse, 3 greenhouses, office, heating plant on Oneida Lake Shore, to Lord & Burnham, Irvington. Est. $35,000. Noted Nov. 15.

Tex., Palacios — BATHHOUSE, PAVILION, etc.—See "Earthwork, Irrigation, Drainage and Waterways."

British Columbia—TRANSMISSION LINE—Nanaimo-Duncan Utilities Co., Duncan and British Columbia Electric Ry. Co., Bamberton and Victoria, 60,000 volt line to connect Duncan with Bamberton, separate contracts and day labor. Est. $100,000.

Ont., Toronto—BOARDWALK—City, boardwalk on Lakeshore Blvd. to Comm. of Wks., by day labor. $26,400.

Que., Montreal—WHARF—Harbour Comrs., concrete work for raising wharf at Sects. 38, 39 and 40, to E. G. M. Cape & Co., Montreal, $27,377; and backfill for same, to H. J. O'Connell Ltd., Montreal, $46,000.

Que., Pointe Aux Trembles—RAILWAY TRACK EMBANKMENTS—Montreal Harbor Comrs., constructing railway track embankments at Marien Ave., to H. J. O'Connell, Ltd., Montreal, $58,400.

Que., Quebec City—SHEDS—Quebec Harbour Comrs., constructing 2 sheds on Piers 1 and 2, to Delphe Noranda, Quebec City, $354,754.

MATERIALS AND EQUIPMENT

PROPOSED WORK

CRUSHED ROCK, etc.—**Los Angeles, Calif.**—City, A. J. Holm, purch. agt., City Hall, rejected bids Oct. 19, furnishing 6,500 tons Nos. 2, 3 or 4 crushed rock per month from date of award to Dec. 31, 1934, Spec. 3350. To exceed $1,000.

INSULATORS, etc.—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., rejected bids Nov. 2, furnishing, delivering 1,000 pin-type insulators, 66,000 volt; 1,000 1¾ in. lead tip insulator pins, Spec. 1532. To exceed $2,000. Noted Oct. 25.

IRON and STEEL CASTINGS, etc.—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., rejected bids Nov. 1, furnishing as required, iron and steel castings, involving vault frames and covers, manhole frames, inner and outer covers, vent frames and covers, Spec. 1541.

FIRE FIGHTING EQUIPMENT—**Patterson, Calif.**—Property owners in vicinity of here to form fire district and will levy assessment to finance purchase of motor fire engine and other fire fighting equipment. To exceed $5,000.

MOTOR TRUCK — **Sacramento, Calif.** — City Council plans purchasing 4 ton motor truck for Recreation Dpt.

†FENCING, etc.—**San Rafael, Calif.**—Con. Q.M., Hamilton Field, cancelled bids to have been opened Oct. 31, fencing and gateways at Hamilton Field. Noted Oct. 11.

SNOW PLOWS—**Stratford, Conn.**—Town, D. S. Sammis, town mgr., plans purchasing 2 snow plows.

ROAD MACHINERY—**Remus Point, N. Y.**—Town of Ellery, J. F. Ward, clk., plans purchasing road grading machine and other highway maintenance equipment. $2,000.

SNOW-REMOVING EQUIPMENT — **Hempstead, N. Y.**—Hempstead Town Bd. voted $9,850 appropriation for purchase of snow-removing equipment.

FIRE TRUCK — **Lewiston, N. Y.** — Village, N. L. Walker, capt. Fire Dpt., plans purchasing fire truck and equipment. **Maturity in spring. $4,000.**

SNOW FENCE—**Little Valley, N. Y.**—Supervs. Cattaraugus Co. soon takes bids 20,000-30,000 lin.ft. snow fence. W. Bowen, supt. County Hy. Dpt. To exceed $1,000.

†*Federal Government.*

Materials, etc. (Continued)

TANKS—Syracuse, N. Y.—Crew Levick Co., Chimes Bldg., plans completed and soon awards separate contracts storage tanks and concrete foundations.

TANKS—Cherry Tree, Pa.—Cyrus Green, Cherry Tree, plans installing two 1,000 gal. steel tanks at gasoline filling station to replace equipment recently destroyed by fire.

TANKS—Coatesville, Pa.—Atlantic Refining Co., 26 South Broad St., Phila., plans installing four 500 gal. tanks at service station in Coatesville.

BIDS ASKED

PIPE, etc.—**Grass Valley, Calif.**—City Council taking bids furnishing 2,250 ft. 10 in. and 950 ft.-8 in. pipe together with fittings.

BUTTERFLY VALVE—**San Francisco, Calif.**—Nov. 30, by T. A. Brooks, City purch. agt., City Hall, one 66 in. butterfly valve.

†TURBO-ALTERNATOR, etc.—**Wash., D. C.**—Nov. 28, by Yards & Docks, Navy Dpt., Wash., D. C., 300 kw. turbo-alternator and exciter at Naval Air Station, Guam, Spec. 7835; automatic oil burner for heating boiler with storage tank and accessories at Naval Air Station, Spec. 7840.

TRUCK PARTS—**Indiana**—Nov. 30, by State Hy. Comn., Indianapolis, quantity auto and truck parts, f.o.b. Indianapolis: 1,200 to 2,000 tons crushed aggregate between Spencer and Vandalia; 900-1,000 tons gravel or crushed aggregate in Waterloo Sub-Districts; 1 storage tank for bituminous materials, at Greencastle; 3,500 to 4,000 tons 5, 45, and 6 crushed aggregate on state roads in Seymour Sub-Dist.; hardware, f.o.b. Indianapolis; 600-1,000 ft. trunk flare torches, f.o.b. Indianapolis.

GENERATING EQUIPMENT — **South Bend, Ind.**—The Hunter Co., engrs., 608 South Dearborn St., Chicago, Ill., taking bids 350 kw. generating equipment, undecided type, 150 hp. high pressure boilers, pumps, switchboard equipment and electric motors, for Oliver Hotel.

GRAVEL—**Ackerman, Miss.**—Dec. 3, by Bd. Supervs. Choctaw Co., 3,000 tons gravel for use on county roads. A. M. Buck, clk.

TURBINES—**Nebraska**—See "Earthwork, Irrigation, Drainage, Waterways."

TANKS — **Jamestown, N. Y.** — Superior Oil Wks., Warren, Pa., taking bids three 18,000 gal. steel tanks for gasoline storage plant. H. G. Easton, pres.

SINGLE SPANS, etc.—**Raleigh, N. C.**—Nov. 27, by Div. Purchase & Contr., A. S. Brower, dir., furnishing single spans for timber substructures, three 30 ft., 8,940 lb.; three 35 ft. 11,640 lbs., three 40 ft. 13,080 lbs., three 45 ft. 17,760 ft.; two 50 ft., 13,040 lbs., 1,000 road machine blades, saws and handles, miscellaneous steel, rag blades, manganese, electric welding generator with flexible coupling for electric drive, 16 kw. unit not mounted, 400 amp. at 40 volts.

STEAM TRACTOR—**Waugh, Alta.**—A. Dwornuik, Main St., in market for steam tractor.

PIPE—**Oakville, Ont.**—Geo. H. Power, engr., Watson St., taking bids 1,700 ft. pipe, 3 hydrants, valves, etc., for Central Ave. watermain, for Trafalgar Twp.

BRASS and BRONZE FITTINGS, etc.—**Toronto, Ont.**—Nov. 27, by Bd. Control, brass and bronze fittings, alloy fittings for water service pipes, c.i. pipes, hydrants, pipe fittings, valves, special castings, sewer brick, mineral dust or filler, Portland cement, flat castings, gravel, stone, house numbers, oil and grease, sewer pipe, hose, tires, refined asphalt, tools, liquid chlorine, lumber, bronze check valves, etc.

GATE VALVES—**Toronto, Ont.**—Nov. 27, by W. J. Stewart, chn. Bd. Control, supply and delivery of 24 and 36 in. gate valves.

GENERATOR—**North Battleford, Sask.**—Power Com. in market for 1,500 kw. turbo-generator, $35,000.

CONTRACTS AWARDED

WIRE ROPE—**Los Angeles, Calif.**—D. P. Nicklin, purch. agt. Dpt. Water & Power, 207 South Bway., furnishing, delivering 48,000 ft. ¼ in. wire rope, to John A. Roeblings Sons, 216 South Alameda St., $5,040; 18,000 ft. ¾ in. wire rope, to Crook Co., 2900 Santa Fe Ave., $1,530, both Spec. 1528, f.o.b. Yermo. Bids Oct. 18. Noted Nov. 9.

PIPE—**Santa Cruz, Calif.**—S. A. Evans, city clk., 2,300 ft. 12 in. Class 150 c.i. pipe, B and S joints, not less than 12 ft. lengths, 12 double bell tees, 12x4 in., to U. S. Pipe & Fdry. Co., Monadnock Bldg., San Francisco, $4,124. Bids Nov. 4.

SURFACE MATERIALS, etc.—**Astoria, Ill.**—Dpt. P. Wks. & Buildings, Div. Hys., to Independent Road Supply Co., Mount Sterling, 900 tons bar bound surface course and 630 lin.ft. 12- to 24-in. culvert pipe on Sects. 1 and 2CS ***to Standard Concrete Pipe Co., Springfield, 1 catch basin at $10, 2 grates, Type 2, $16, and 32.5 ft. 12 in. storm sewer in Sects. 1 and 2CS. Bids Nov. 5.

†Federal Government.

COARSE AGGREGATE, etc.—**Greenville, Ill.**—City, 277 tons coarse aggregate and 170 tons sand, to W. F. McLain, Greenville, $2.15 and $1.45 per ton respectively; 390 bbl. cement, to Greenville Lumber Co., Greenville, $2.36 per bbl., all above material for use on Sect. 1CS. Bids Nov. 9.

STONE, etc.—**Urbana, Ill.**—Dpt. P. Wks. & Buildings, Div. Hys., 1,600 tons stone, to Lehigh Stone Co., Kankakee, at $1.58 per ton, total $2,528***1,090 tons sand, to Lincoln Sand & Gravel Co., Lincoln, $1.45 per ton, total $1,581***steel and joints, to R. B. Leonard Co., East Peoria, $1,480***steel and joints, to American Steel & Wire Co., 208 South LaSalle St., Chicago, $1,483***2,620 bbl. bulk cement, to Universal Atlas Cement Co., 208 South LaSalle St., Chicago, $1.95 per bbl., total $5,109. Grand total $12,181. Bids Oct. 18.

OXYGEN MANIFOLD, etc.—**Worcester, Mass.**—City, W. B. Dennen, dir. Worcester Trade School, furnishing one 10 cylinder single standard oxygen manifold with regulators for 5 cylinders, each, 2 generators also valves and outlets for 20 welding units, material for boiler, includes 175 two inch tubes, National seamless HP 13 BWG tested 1,000 lbs., generators, 20 each acetylene and oxygen valves, to Linde Air Products Co., 961 Southbridge St., $675***oxygen manifold, to Air Reduction Sales Co., 122 Mt. Vernon St., Dorchester, $150***boiler material, to C. S. Stewart & Son, Inc., 250 Albany St., Worcester, $645. Grand total $1,470. Noted Oct. 25.

†BARS and STEEL SPACER BARS, etc.—**Vicksburg, Miss.**—U. S. Eng., Box 667, furnishing, delivering tapered steel grizzly bars and steel spacer bars, to W. C. Ellis & Sons Iron Wks., 245 South Front St., Memphis, Tenn., $443***3,000 drop forged galvanized steel heavy duty wire rope clips, to J. E. Dilworth, 353 South Front St., Memphis, Tenn., $581*** 5,000 lb. low carbon electric welding rods, to Modern Eng. Co., 358 Madison Ave., Memphis, Tenn., $354. Grand total $1,378. Bids Nov. 6.

†LUMBER—**Bennett, Mo.**—U. S. Eng., Postal Telegraph Bldg., Kansas City, supplying 3,000,000 bd.ft. lumber for mattress work, to Buschow Lumber Co., 3525 Bway., Kansas City, $88,867, incl. freight. Est. $40,000. Bids Oct. 26, awarded Nov. 6. Noted Oct. 25.

ELECTRIC SIGNS—**St. Louis, Mo.**—Bd. P. Serv., City Hall, furnishing, erecting electric signs for municipal auditorium and community center building at 14th and Market Sts., to E. F. Guth Co., 2614 Washington Ave., $7,760. **P.W.A.** Bids Oct. 26.

†SUCTION PIPES—**Montana**—U. S. Eng., Postal Telegraph Bldg., Kansas City, Mo., ladder well suction pipes for Fort Peck Dam, to National-Erie Corp., 16th and Raspberry Sts., Erie, Pa., $2,520, less 2%. Bids Nov. 16, awarded Nov. 16.

TANKS—**Rochester, N. Y.**—Hub Oil Co., 770 Exchange St., concrete foundations for 500,000 gal. tanks, to F. J. Hines, 79 Monteroy Rd., steel tank, to Buffalo Tank Corp., 153 Lincoln Ave., Lackawanna.

TRENCH CABLE—**Raleigh, N. C.**—Div. Purchase & Contr., A. S. Brower, dir., furnishing lubricant seventy-five 100 lb. steel drums No. 00, and twenty-five 100 lb. steel drums No. 3, four hundred 25 lb. tins or pails pressure grease, to Sinclair Refining Co., 205 East 42nd St., New York, $822. Bids Nov. 8.

†KITCHEN EQUIPMENT — **Phila., Pa.** — Yards & Docks, Navy Dpt., Wash., D. C., kitchen equipment at Naval Hospital, Spec. 7715, to Duparquet Range Co., 1215 Fullerton Ave., Chicago, Ill., $56,457.

†OIL BARGE—**Norfolk, Va.**—U. S. Eng., Norfolk, steel oil barge, to Bethlehem Shipbuilding Corp., 25 Bway., New York, $14,750. Bids Oct. 19. Noted Oct. 4.

PIPE, etc.—**Baraboo, Wis.**—City, furnishing water pipe, fittings, valves, and pump, to L. C. Welch Co., Baraboo, $1,800. Bids Nov. 5. Noted Nov. 8.

SEWER PIPE—**Random Lake, Wis.**—City, furnishing sewer pipe, to Utility Constr. Co., Sheboygan, $1,083. Bids Oct. 22.

†BARGES—**Jacksonville, Fla.**—U. S. Eng., 2 steel deck barges, to Alabama Dry Dock & Shipbuilding Corp., foot Canal St., Mobile, Ala., $15,694; 6 steel deck barges, to Ingalls Iron Wks. Co., 720 4th Ave., Birmingham, Ala., $70,534.

FOREIGN

Argentina, Buenos Aires—Diesel Burlap & Canvas Cordage Co. plans plant. $750,000.

China, Chufu — Committee for Confucian Temple at Chufu, c/o Chinese Government, Shanghai, plans repairing, reconditioning and restoration Confucian Temple. Est. about $1,000,000.

China, Shanghai—Sun Co. Ltd., Shanghai, plans by J. Graham, Dexter Horton Bldg., Seattle, Wash., 8 story, rein.-con. department store. $2,000,000.

England—Portsmouth Air Ministry preparing plans constructing air base at Thorney Island, $600,000***Dec. 3, by County Council Clerk, **London**, constructing re-aeration channels, etc., 24,000 cu.yd. excav., 17,000 cu.yd. demolition work, 4,000 cu.yd. mass concrete, 5,000 cu.yd. rein.-con., 400 tons structural steel, etc., at Northern Outfall Plant***Weymount Municipality bids in December, 200 houses, $295,000 ***Herts Education Committee, **St. Albans**, bids in December, school, $352,000.

England, Coventry — Courtaulds Ltd., London and Coventry, plans plant for transparent wrapping materials. Est. about $500,000.

England, Southampton—City Council, supply and erection turbo-alternator 25,000 kw. capacity complete with condensing plant.

Irish Free State—Wexford Municipality takes bids in December for 154 houses, $261,750*** Mental Hospital Committee, **Ballinsloe**, plans additional buildings, $1,660,000.

Jamaica, Kingston—Municipality plans housing and slum clearance, $1,125,000.

Mexico—National Railways of Mexico, c/o Government of Mexico, Mexico City, plans constructing new railway from Ejutla, State of Oaxaca to Pochutla on Pacific Coast. To exceed $1,000,000.

Mexico, Piedras Negras—City, c/o Francisco Cardenas, Piedras Negras, plans 2 story, 35 x 117 ft., brick hospital. $110,000. Private **plans.**

Northern Ireland, Belfast—Estates Committee of City Council bids in December constructing 500 houses. $687,500.

Scotland, Loanhead—Municipality plans constructing low temperature coal carbonization plant.

Union Socialist Soviet Republics—Commissariat of Heavy Industry, Moscow, or c/o Amtorg Trading Corp., 261 5th Ave., New York, constructing 2nd Kuznetz Steel Mill by day labor. To exceed $3,000,000.

Union Socialist Soviet Republics—Commissariat Heavy Industry, Moscow, or c/o Amtorg Trading Co., 261 5th Ave., New York, developing iron ore deposits at Kursk, Central Black Soil Region, by day labor. To exceed $500,000.

Union Socialist Soviet Republics — Municipality, c/o Amtorg Trading Corp., 261 5th Ave., New York, waterworks system, doubling present supply, to increase capacity from 143,000,000 to 325,000,000, gal., day labor.

DETAILS OF PWA NON-FEDERAL ALLOTMENTS

Loans and Grants Except as Noted.

*Grant. †Loan.

KEY TO SYMBOLS

m-meters	**c**-canal
p-pump	**dm**-dam
t-tank or standpipe	**r**-reservoir
f-filtration	**tr**-treatment plant
d-distr. supt.	**b**-building
w-well	**i**-iron removal
s-supply	**pw**-power line
g-generator	**sf**-softening
ch-chlorinators	**bl**-boilers

Waterworks

Amboy, Ill., **p-f-r**	$30,000
Amherst Co., Va. (complete system)	90,000
Arlington, Ky., well-pumping station, chlorinator, elevated storage tank, dist., fire hydrants	38,000
Belen, N. Mex. (water and sewer extensions)	45,600
Brielle, N. J., **w-p-t-d**	40,000
Camden, N. J., **w-p-d**	124,000
Cedar Grove, N. J., **d**	22,000
Colon, Mich. (complete system)	48,000
Flushing, Ohio, **w-p-t-d**	60,000
Franklin, N. C., **s-f-d-t** (also sewers and disposal plant)	122,000
Henrico, Va. (complete system)	100,000
Hurricane, W. Va., **w-t-d-tr**	51,000
Irvington, N. J., **w-p-t-d**	16,000
Jackson, La., **w-p-r-t-d**	41,000
Manor, Tex., **w-p-t-r-d**	42,000
Mayesville, S. C. (complete system)	24,000
Middleburg, Va., **w-p-t-d** (also sewer and sewage treatment plant)	35,000
Mineral, Va. (complete system)	30,000
Mount Olive, Ill., **dm-r-f-p-t-d**	115,000
Murfreesboro, Ark., **w-p-r-t-d**	43,000
New Concord, Ohio, **f-tr-ch**	30,000
Portland, Ark., **w-p-t-d**	32,000
Princeton, Wis. (complete system)	100,000
Roy, N. Mex. (complete system)	40,000
Shaler Township, Pa., **t-d**	414,000
Strasburg, Va., **r-d**	23,000
St. Joseph, La., **f-tr**	6,700
Toyah, Tex., **d**	26,000

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Details of P.W.A., etc. (Continued)

Varnville, S. C. (complete system)	27,000
Versailles, Ohio, w-p-d-pw	14,600
Washington, Va., r-d	25,000
Wenona, Ill., w-p-d	12,000

Sanitary Sewers

Audubon, N. J.	35,000

Sewage Disposal Plants

Bradley Beach, N. J. (sewage tanks, pumping equipment)	54,000
Island Heights, N. J.	66,000
Seal Beach, Calif.	52,000

Sewers and Disposal Plants

Freeport, Ill.	291,000
*Matteson, Ill.	39,000
Sunset Beach, Calif. (sewage collection, pumping plants)	44,000

Bridges

*Norfolk, Va.	119,000

Street or Road Construction

*Hale Co., Tex.	100,500

Earthwork, Irrigation and Drainage

Hidalgo Co., Tex. (irrigation)	570,000
Monmouth Co., N. J. (Jetties)	36,000
*Oklahoma Co., Okla.	3,600
Ouachita Parish, La.	74,000

Buildings

Front Royal, Va. (office, library, etc.)	35,000
Front Royal, Va. (court house)	50,000
*Honolulu, Hawaii (agricultural building and library addition)	49,000
Laurel, Md. (fire station)	7,900
New York, N. Y. (elevator equipment municipal building)	1,772,300
New York, N. Y. (nurses home Sea View Hospital)	494,000
Raleigh, N. C. (hospital)	350,000
Richmond, Va. (central heating plant)	130,000
*Roland, Iowa (water treatment plant housing, fire station and jail)	5,400
Sweetwater, Tex. (hospital)	73,100
Tyler, Tex. (library addition)	25,000

Schools

*Amherst Co., Va.	18,700
Atascosa Co., Tex.	7,800
Covelo, Calif.	39,200
Danville, Va.	319,500
Chapman Co., Kan.	45,600
Dunellen, N. J.	85,000
Ellis Co., Tex.	8,500
Farwell, Tex. (auditorium and gymnasium)	22,400
Forks Township, Pa.	50,000
Frio Co., Tex.	6,900
Front Royal, Va.	49,000
*Grayson Co., Va.	28,500
Hamilton Co., Ohio	95,500
Hinsdale, Mass.	12,500
Kearney, N. J.	310,000
Kiowa, Kan.	50,400
New York, N. Y. (addition P. S. 225, Brighton Beach Sect.)	335,500
Oxford Co., Me.	110,000
Pemiscot Co., Mo.	38,000
Penn Township, Pa.	335,000
Riverton, N. J.	85,000
Teaneck, N. J.	635,000
Santa Ynez Valley, Santa Barbara County, Calif.	93,600
Wharton Co., Tex.	56,800
Whiteside Co., Ill.	4,000

Miscellaneous

Beatrice, Neb. (electric distribution system)	575,000
*Cincinnati, Ohio (park improvement)	18,000
Newport News, Va. (stadium)	29,700
*Stockton, Calif. (port and dock facilities incl. three warehouses)	29,000

PUBLIC BUILDINGS

PROPOSED WORK

Calif., Berkeley—Berkeley City Elementary School Dist., defeated $2,216,500 bonds for 3 new elementary schools and rehabilitation of Garfield and Edison Junior High Schools; also $677,000 for additional units for high school groups, new shops, auditorium. Noted Dec. 21.

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Calif., Pasadena—Bd. Educ., plans by C. Bennett, 311 1st Trust Bldg., and Marston & Maybury, 26 South Euclid Ave., altering and reconstructing east and west wings and auditorium of Pasadena Junior College. $200,000.

Calif., Redwood City—San Mateo Co., defeated bonds for 4 story, rein.-con. office building (courthouse annex). $115,000. Noted Oct. 18.

Calif., Sacramento — Sacramento Dist. and County voted $12,000,000 to construct electric distribution system and steam generating plant, for Sacramento Municipal Utility Dist. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs. Noted Oct. 18.

Calif., San Jose—Santa Clara Co., defeated $250,000, for county hospital. Binder & Curtis, 35 West San Carlos St., archts. Noted Oct. 18.

†Conn., Fairfield—Treas. Dpt. at office Sup. Archt., Wash., D. C., plans U. S. Post Office, Post Rd. between Center St. and Unquowa Pl. $75,000. Site selected.

†D. C., Wash.—Federal Reserve Bd., A. C. Miller, chn. Building Com., Wash., D. C., plans bank, Constitution Ave. near 18th St. To exceed $400,000. Architect not appointed.

Fla., Fernandina—Municipality will not build paper mill. $4,500,000. Project abandoned. Union Bag & Paper Co., Woolworth Bldg., New York, were to have been lessees. P.W.A. funds were requested and loan denied. Noted Mar. 15.

Fla., Jacksonville—Municipality plans electric power plant addition. $430,000. Taylor Eng. Co., Jacksonville, engrs.

†Ill., Chicago—Federal Housing Bd., Dpt. Interior, plans by ten architects for slum clearance and low cost housing program, incl. 2, 3 and 4 story apartments and row houses on southwest side. $12,500,000 P.W.A. allotment. J. Holabird, 33 North Michigan Ave., will act as director of the architectural firms. Rich, Neiler & Rich, Chicago, engrs.

†Ind., Indianapolis—Housing Div., Public Works Administration, Wash., D. C., plans constructing fifteen 3 and 4 story apartment buildings and ninety-two 2 story row houses, for low cost housing and slum clearance for negro occupancy at Indiana Ave., Blake, North and Locke Sts. $3,000,000.

Ia., Decorah—Bd. Educ. bids about December, 2 story, basement, brick, steel school, plain found. $135,000. P.W.A. allotted $37,500 grant. C. Altfillisch, city engr. Noted Sept. 27.

Ia., Iowa City—P.W.A. rescinded $917,000 loan and grant for power plant and distribution system, for City, upon applicant's request. Noted May 3.

Mass., Watertown—Town, C. F. Shaw, chn. Building Comn., Town Hall, plans to be refigured by Frank Irving Cooper Corp., 47 Winter St., Boston, 3 story, basement, 65x104 ft. addition to Senior High School, Common and Columbia Sts. $150,000. R. D. Kimball Co., 6 Beacon St., Boston, engrs. Noted Nov. 15.

†Miss., Biloxi — U. S. Coast Guard Headquarter, Wash., D. C., plans barracks, buildings and equipment at Biloxi Air Base. $107,000 allotted.

Mo., Independence—Bd. Educ., rejected bids Oct. 16, constructing 2 story, basement, rein.-con., brick West School, and rejected bids Oct. 18, 2 story, basement, Noland School. P.W.A. project. Noted Oct. 15.

Mo., St. Louis—City, Bd. P. Serv., B. L. Brown, pres., 304 City Hall, bids in December or January, 4, 5 and 6 story, basement, subbasement, 40x220 ft., rein.-con., brick, south ward building for Homer G. Phillips City Hospital for Colored, St. Ferdinand, Whittier, Kennerly and Goode Aves. $525,000. P.W.A. project. A. Osburg, City Hall, archt. W. C. E. Becker, City Hall, engr.

†Mont., Fort Harrison—Vet. Bu., Wash., D. C., plans dining hall and kitchen at Veterans' Hospital. $200,000.

Nebraska—State Bd. Control, Capitol Bldg., Lincoln, made 1935 budget requests, incl. constructing new store room, boys' cottage, remodeling store building, new walls and roof for boiler house, water supply, addition to and remodeling school building, and equipment, laundry machinery at Institution for Feeble Minded, Beatrice, $202,000***porch on hospital building, laundry equipment, 3 irrigation wells and pumps, at Grand Island, $16,500*** electric wiring, replacing engine and boiler in power house, new pump for water supply, food elevators, watermains, sewage disposal plant, laundry equipment, 2 new silos and grain storage bin, reconditioning old wells, shoe shop equipment, new kitchen building and equipment, hydrotherapy department, fireproofing new buildings and repairing old buildings, night watch cottage and various equipment, remodeling south annex, etc., at Hastings State Hospital for Insane, Ingleside, $400,500***school building and equipment, new boiler house, at State Industrial School, $49,000; and boiler house and boilers, new buildings for men, and equipment, for Tuberculosis Hospital, $145,000, at Kearney***septic tanks, electric transformers, main building, reconstructed with addition, refrigeration unit, canning factory, barns, root cellar, industrial trades building, at State Reformatory for Men, Lincoln, $260,150***new power line to hospital, transmission line and transformers, kitchen and dining room [illegible] ture, repairing south wall, laundry and [illegible] tory building, equipment for industries, for [illegible] Penitentiary, Lincoln, $294,500***repl[illegible] equipment at Orthopedic Hospital, Li[illegible] $1,500***cottage for women and equip[illegible] night watch cottage and equipment, cr[illegible] insane building and equipment, new [illegible] water supply, power line and meters, at Li[illegible] State Hospital, $335,000***resetting bo[illegible] dairy barn and equipment, at Soldiers & S[illegible] Home, $23,000, and resetting boilers, at N[illegible] braska Industrial Home, $1,500, both at [illegible] ford***female building addition and e[illegible] ment, farm cottage and equipment, new s[illegible] room, dairy and horse barn, new well, g[illegible] ator, fire pump, irrigation wells, at Nor[illegible] State Hospital, Norfolk, $227,000***additi[illegible] school house unit, new hospital building equipment, general repairs and replacement[illegible] School for Deaf, Omaha, $97,500. Total [illegible] 053,150.

N. J., Morristown—Town, bids after Feb. 1 3 story, basement, brick, steel library and [illegible] seum, $180,000. John Russell Pope, 542 [illegible] Ave., New York, consult. archt. Noted Oct. 25

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, plans School 201, $257,000. P.W.A. funds allotted. W. V. Martin, Flatbush Ave. extension and Concord St., archt.

N. Y., Brooklyn—Dpt. Hospitals, Municipal Bldg., New York, plans by LeR. P. Ward, 205 East 42nd St., New York, staff house at Kings County Hospital. $231,000 funds allotted by P.W.A.

†N. Y., Brooklyn—Municipal Housing Authority, D. L. Hoopingarner, associate dir. Housing Div. reached agreement with P.W.A. whereby P.W.A. will acquire land and lease to Authority for housing and slum clearance project in Williamsburg section, Bushwick Ave., Leonard, Mayer and Scholes Sts. Est. $12,000,000 P.W.A. loan and grant.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, sketches by C. W. Martin, Flatbush Ave. extension and Concord St., construction elementary and junior high school, in Williamsburg Dist. $1,500,000. Owner now applying for P.W.A. loan.

N. Y., New York—Bd. Educ., 500 Park Ave., plans by W. C. Martin, Flatbush Ave. extension and Concord St., Brooklyn, School 43, $1,101,000 funds allotted by P.W.A.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., bids in December, new elevators and elevator repairs (32 elevators) in Municipal Building, Bureau of Buildings & Offices, Municipal Bldg., engrs. and archts. $1,772,000. P.W.A. funds allotted.

N. Y., South Glens Falls—Village plans by M. L. Crandell, Masonic Bldg., 2 story, basement, 98x100 ft. and 57x184 ft., brick, steel grade and high school, plain found. $200,000.

†N. C., Graham—Treas. Dpt. at office Sup. Archt., Wash., D. C., plans U. S. Post Office, $50,000. Site selected.

†N. C., Roanoke Rapids—Treas. Dpt. at office Sup. Archt., Wash., D. C., making surveys U. S. Post Office. $65,000. Site selected.

†N. C., Smithfield—Treas. Dpt. at office Sup. Archt., Wash., D. C., plans post office, $65,000. Will issue advertisements for site within a week.

N. D., Grand Forks — University of North Dakota, plans experimental hydrogenation plant and laboratory. $200,000. P.W.A. funds applied for.

†O., Cleveland — Public Works Emergency Housing Corp., R. W. Du Bois, mgr., 1276 West 3rd St., plans by W. R. McCornack, 10006 Carnegie Ave., 3 story, basement, steel, brick or tile apartments, with stores and offices for slum elimination, Central and Cedar Aves., East 22nd to East 30th Sts. $2,800,000. J. P. Jones, Terminal Tower, mechanical engr.

O., Dover—City plans electric power plant. $330,000. P.W.A. project. W. Hartline, Dover, engr. Noted Oct. 4.

O., Wapakoneta—Municipality, plans electric power generating plant. $160,000. Maturity soon.

Okla., Enid—City defeated $150,000 bonds for school addition. R. W. Shaw, Enid, engr. Noted Oct. 11.

Pa., Emaus—Borough will not construct power plant. $265,000. Project abandoned. Noted Aug. 23.

Pa., New Castle—City plans power plant and distribution system. Burns & McDonnell Eng. Co., 107 West Linwood Blvd., Kansas City, Mo., engrs.

Pa., New Castle—City plans 2 story, basement grade school in Edison-Winter Ave. section. $150,000. Architect not appointed.

R. I., Howard—State, Dr. F. J. Farnell, chn. State P. Welfare Comn., soon takes bids 3 story, irregular sized, brick, steel employees' dormitories. $235,000. Howe & Church, 1014 Turks Head Bldg., Providence, archts. Noted Feb. 15.

R. I., Newport—Newport Hospital, Friendship St., plans brick, steel maternity unit, East Friendship St. $105,000. Architect not appointed.

†Federal Government

Public Buildings, etc. (Continued)

†S. C., Columbia—Treas. Dpt. at office Sup. Archt., Wash., D. C., making plans constructing 3 story, basement, 50x203 ft. weather bureau over Federal Court rooms, Laurel and Assembly Sts. $300,000. G. O. Van Nerta, Federal Bldg., 9th and D Sts., Wash., D. C., engr. H. Tatum, Kinard Bldg., Columbia, archt.

Tenn., Knoxville—City, Public Schools, E. L. Adcock, bus. mgr., plans by Barber & McMurry, 517 West Church Ave., Junior High School, part 1 and part 2 story, 270x320 ft., brick, rein.-con., plain found., Warren Ave., est. about $200,000; plans by Baumann & Baumann, 813½ Market St., 2 story, part basement, 145x285 ft., brick school, plain found., Linden Ave., $140,000. P.W.A. project. Plans in hands of P.W.A. Bd. when approved will set date for bids. Noted Sept. 27.

Tenn., Knoxville—City authorized Burns & McDonnell Eng. Co., engrs., 107 West Linwood Blvd., Kansas City, Mo., to proceed with plans for light plant and distribution system, $3,000,000. T.V.A. will not purchase private utility. Noted July 5, under "Unclassified."

†Tex., San Antonio—Con. Q.M., plans by B. W. Spillman, Alamo Natl. Bank Bldg., 9 story, brick, steel fireproof hospital, at Argonne Heights. $1,953,000. Noted Nov. 8.

Tex., Sherman—Grayson Co., c/o J. J. Loy, judge, submitting revised application to P.W.A. for loan to finance construction of new courthouse. $300,000. Voelker & Dixon, 913½ Indiana Ave., Wichita Falls, archts. Noted Aug. 3.

Utah, Parowan—City, election Dec. 17, to vote bonds to secure $76,000 P.W.A. loan to repair hydro-electric plant, $36,000, and repairing water system, $40,000. Caldwell & Richards, Templeton Bldg., Salt Lake City, engrs. Noted Feb. 8.

Va., Lexington—Municipality sketches municipal electric power plant. To exceed $100,000.

Wash., Seattle—Bd. Regents, University of Washington, plans J. Graham, Dexter Horton Bldg., and Bebb & Gould, Hoge Bldg., 4 story, fireproof infirmary, $150,000. P.W.A. project. Noted Aug. 2.

BIDS ASKED

Calif., Camarillo—Dec. 4, by G. B. McDougall, state archt., Sacramento, rein.-con. kitchen and dining room building and boiler plant for Camarillo State Hospital. Noted Oct. 25.

Calif., Oakland—Dec. 12, by Supervs. Alameda Co., 12 story, steel frame, rein.-con., earthquake proof court house, 3 lower floors, 176x245 ft. and upper floors 116x116 ft., 12th, Fallon, Oak and 13th Sts. $1,750,000. G. M. Simonson, 20 Loreta Ave., Piedmont, consult., mechanical and electrical engr. W. G. Corlett, J. E. Plachek, W. E. Schirmer, C. Werner and H. A. Minton, associated archts., 910 Bank of America Bldg. Noted Aug. 16.

†Calif., San Francisco—Nov. 30, by Con. Q.M., Fort Mason, constructing one 11 unit rein.-con. garage with alternate 3 additional units, incl. road work and pavement, at Fort Miley.

Calif., Sebastopol—Dec. 4, by Trustees of Analy Union High School Dist., 2 story, rein.-con. high school. $200,000. L. C. Stone and J. R. Rowell, Humboldt Bank Bldg., San Francisco, archts. N. Green, 5 New Montgomery St., San Francisco, engr. Noted Nov. 15.

Ga., Reidsville—Nov. 23 (extended date), by H. Johnston, state P.W.A. engr., U. S. Federal Court Bldg., Atlanta, 4 story, basement, prison, for State of Georgia, Atlanta, $1,300,000. Noted Oct. 18.

†Ky., Lexington—Nov. 30, by Treas. Dpt. at office Sup. Archt., Wash., D. C., special interior lighting fixtures.

Ill., Urbana—Dec. 6, by Bd. Educ., P. B. Harper, pres., school, $121,000. P.W.A. project. H. A. Smith, Urbana, archt.

Ind., Indianapolis—Dec. 5, by School Comrs., A. B. Good, dir., constructing Broad Ripple High School Building, brick, steel, 1115 East 63rd St. $114,000. Vonnegut-Bohn & Mueller, 610 Ind. Trust Bldg., Indianapolis, archts. Noted Oct. 25.

†La., Baton Rouge—Dec. 4, by Treas. Dpt. at office Sup. Archt., Wash., D. C., entrance vestibule at post office and court house.

†Mich., Detroit—Nov. 30, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing garage at U. S. Immigration Station.

Mich., Manistee—Nov. 27, by Mrs. L. Brugman, secy. Bd. Educ., 2 story, basement, rein.-con. brick, steel school, plain found. $105,000. P.W.A. project. Robinson & Campau, 760 Michigan Trust Bldg., Grand Rapids, archts.

†Nev., Reno—Dec. 11, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

N. J., Annandale—Dec. 6, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, housing for inmates and underground steam conduit for New Jersey Reformatory. $80,000. C. N. Leathem, Jr., State Bldg., Trenton, archt. Noted Aug. 30.

N. Y., Pine Aire Station—Nov. 28, by Dpt. Mental Hygiene, State Office Bldg., Albany, general contract, heating, plumbing, electrical work for assembly hall for Pilgrim State Hospital, $218,300.

†Federal Government.

N. Y., South Glens Falls—Dec. 4, by Bd. Educ., general contract, heating, ventilating, plumbing, electrical work, high school building, $183,830. P.W.A. project. Noted Nov. 15.

N. Y., South Jamaica—Nov. 30, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., Brooklyn, general contract, plumbing and drainage, heating and ventilating, electrical work, lighting fixtures for New P. S. 48, 108th Ave. from 155th to 156th St., for Bd. Educ., 500 Park Ave., New York.

†Ore., Newburg—Dec. 12, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Sept. 13.

†S. D., Wagner—Dec. 3, by Dpt. Interior, W. B. Fry, purchasing Officer, 1 story, basement Indian Hospital, $80,000. Schmidt, Garden & Erikson, 104 South Michigan Ave., Chicago, Ill., archts.

Tex., Port Arthur—Nov. 30, by Jefferson Co., c/o B. R. Johnson, judge, Beaumont, suboffice building and jail, $173,000, P.W.A. project. C. L. Wingall, 915 4th St., assoc. archt. F. C. Stone, Goodhue Bldg., archt. Noted Aug. 2.

†Tex., Shamrock—Dec. 7, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office. Noted Oct. 25.

†Wis., Jefferson—Dec. 4, by Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office.

N. S., Halifax—Nov. 27, by Secretary Dpt. P. Wks., Ottawa, Ont., 9 story, basement, 86 ft. 9 in. x 127 ft. brick, steel, rein.-con. public building, plain found $500,000. T. W. Fuller, Dpt P. Wks, Ottawa, Ont. archt.

CONTRACTS AWARDED

†Calif., Colton—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract U. S. Post Office, to Schuler & McDonald, 1723 Webster St., Oakland, $37,347. Bids Nov. 2. Noted Oct. 4.

Calif., Long Beach — Bd. Educ., 2 story, rein.-con., steel academic building at Jefferson Junior High School, to C. Bongiovanni, 2561 Canyon Dr., Los Angeles, $130,923. **P.W.A.**

Calif., Los Angeles—Los Angeles Bd. Educ., reconstructing, rehabilitating, strengthening main building of Bell High School, to Person & Thiele, 6206 San Vicente Blvd., $230,795. Awarded Nov. 6. **P.W.A.**

Calif., Sacramento—H. G. Denton, city clk., furnishing, installing 1 electric passenger elevator in city library, to Otis Elevator Co., 1 Beach St., San Francisco, $4,373. Bids Oct. 25, awarded Nov. 5.

†Calif., Santa Clara—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to K. E. Parker, 136 South Park St., San Francisco, $30,900. Bids Sept. 27. Noted Aug. 30.

†D. C., Wash.—Treas. Dpt. at office Sup. Archt., Wash., D. C., erecting hollow tile partitions, accoustical tile ceilings, etc., in Dpt. of Labor Bldg., to G. H. Ashbrook, 2113 O St. N.W., $7,499.

Ill., Clinton—Clinton Community High School Dist. 116, R. Robb, principal, general contract 2 story, basement, brick, steel school addition, to W. C. F. Kuhne, Rantoul***plumbing, to Beatty Hardware Co., Beardsville***electrical work, to Hoffman Electric Service Co., Clinton. Est. $105,000. **P.W.A.** Noted Aug. 9.

†Ill., Danville—Treas. Dpt. at office Sup. Archt., Wash., D. C., electric freight elevator in dining hall building, to S. Heller Elevator Co., 240 North Milwaukee St., Milwaukee, Wis., $2,295; electric passenger elevator in Building 11 of Veterans Facility, to A. Kieckhefer Elevator Co., 1100 West St. Paul Ave., Milwaukee, Wis., $5,387. Bids Oct. 2 and 9. Noted Sept. 9.

†Ind., Terre Haute—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract post office, 7th and Cherry Sts., to F. R. Comb & Co., 2113 Chicago Ave., Minneapolis, Minn., $49,853. Bids Oct. 15.

†Ia., Sheldon — Treas. Dpt. at office Sup. Archt., Wash., D. C., brick, concrete U. S. Post Office, to Murch Bros. Constr. Co., 4111 Lindell Blvd., St. Louis, Mo., $38,200. Bids Aug. 29. Noted Aug. 16.

†Kan., Hays—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract 60x66 ft., and 22x25 ft. wing, rein.-con., dark red common brick post office, 23 ft. high, to Busboom & Rauh, Salina, $37,200. Bids Nov. 5. Noted Oct. 11.

†Ky., Winchester—Treas. Dpt. at office Sup. Archt., Wash., D. C., general contract post office, to Smythe & Co., 1416 F St. N.W., Wash., D. C., $31,320. Bids Nov. 29. Noted Nov. 1.

Md., Baltimore—Fidelity & Deposit Co., bonding company, Fidelity Bldg., completion of 4 story, basement, addition to Ward A, and 3 story, basement, tuberculosis building at Baltimore City Hospital, 4940 Eastern Ave., to N. E. Constr. Co., 6 West Madison St., $261,000 and $175,000 respectively. **P.W.A.** Bids Nov. 9, awarded Nov. 13.

†Md., Beltsville — Dpt. Agriculture, Wash., D. C., general contract constructing fruit products laboratory at U. S. Experimental Farm, to Lacchi Constr. Co., Munsey Bldg., Baltimore, $101,900. Bids Sept. 18. Noted Sept. 20.

†Mass., Beverly—Treas. Dpt. at office Sup. Archt., Wash., D. C., remodeling and constructing U. S. Post Office addition, to Concrete Constr. Co., 11 Garfield Ave., Chelsea, $35,777. Bids Oct. 29. Noted Oct. 11.

Mass., Dorchester—Commonwealth of Massachusetts, Dpt. Mental Diseases, State House, Boston, steam main extensions M-3, M-4 and M-29, tuberculosis building, male employees' building and laboratory and mortuary building, to Underground Steam Constr. Co., 65 Pitts St., Boston, $8,032***M-29, lighting fixtures, to Edwin C. Lewis, Inc., 121 Federal St., Boston. **P.W.A.** Bids Oct. 24.

†Mass., Springfield—Turner Constr. Co., general contractors, 138 Newbury St., Boston, reinforcing steel, to J. T. Ryerson & Son, Inc., 3rd St., Cambridge***marble, to Colonial Marble Co., 141 Gore St., Cambridge***rubber tile asphalt, tile floors, to A. E. Pulsifer & Son, 57 Kneeland St., Boston***iron, to Bay State Iron Wks., 842 Main St., West Springfield***structural steel, to Shippers Car Line Corp., Milton, Pa.***metal doors, to H. W. Mayers Co., 80 Boylston St., Boston, for Federal Land Bank, 310 State St. Total est. $225,000. Noted Oct. 11, under "Contracts Awarded."

†N. J., Caldwell—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to C. A. Vezzetti, Inc., 50 State Rd., Palisade, N. J., $40,800. Bids Oct. 22. Noted Nov. 1.

†N. Y., Carthage—W. S. Johnson Building Co., general contractors, steel for U. S. Post Office, to Utica Structural Steel Corp., 2104 Dwyer Ave., Utica, for Treas. Dpt. at office Sup. Archt., Wash., D. C. Noted Oct. 11, under "Contracts Awarded."

†N. Y., New York—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, limestone, granite, on Vesey St., to James Stewart, Inc., 230 Park Ave., $5,597,000. Bids Nov. 9. Noted Nov. 15.

†N. Y., Rosebank—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing quarantine station, to Cape Constr. Co., 556 Fulton St., Brooklyn, $107,560. Bids Oct. 29. Noted Oct. 25.

†N. C., Rockingham—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office, to Farrell Blair, Carville, La., $119,090. Bids Oct. 30. Noted Oct. 11.

N. C., Wentworth—Bd. Educ., Rockingham Co., constructing schools in Stoneville and Simpsonville, to Fowler-Jones Lumber Co., Winston-Salem, $35,479 and $31,853 respectively***school in Bethany, to Geo. W. Kane, Greensboro, $24,990***school in Mayodan, to Southeastern Constr. Co., 218 West 2nd St., Charlotte, $18,388***school in Ruffin, to J. M. Hopper Constr. Co., Leaksville, $30,200. Grand total $140,910. **P.W.A.** Bids Oct. 2.

Okla., Blackwell—Bd. Educ., general contract 3 story, rein.-con., brick high school, to Mattison-Wollack & Co., Key Bldg., Oklahoma City. Est. $220,000. **P.W.A.** Bids Nov. 8. Noted Nov. 8.

†Okla., Clinton—Treas. Dpt. at office Sup. Archt., Wash., D. C., for new post office, to Brockmeyer-Bohle Inc., Missouri Bldg., St. Louis, Mo., $36,294. Est. $50,000. Bids Oct. 26, awarded Nov. 9. Noted Oct. 4.

†Okla., Holdenville—Treas. Dpt. at office Sup. Archt., Wash., D. C., U. S. Post Office, to Lundberg-Richter Co., North Wilkesboro, N. C., $42,363. Est. $50,000. Bids Nov. 5. Noted Oct. 11.

R. I., Newport — City, H. T. Lowe, supt. Schools plumbing for Potter School addition, Elm St., to Wm. T. Fortin, Inc., 886 Main St., Pawtucket***electrical work, to New England Machine & Electric Co., 77 Bayley St., Pawtucket***heating, to Taylor Heating Co., 714 Broad St., Providence. **P.W.A.** Noted Nov. 8, under "Contracts Awarded."

†Tex., Colorado—Treas. Dpt. at office Sup. Archt., Wash., D. C., constructing U. S. Post Office, to Templeton-Cannon, San Angelo, $34,320. Bids Sept. 24. Noted Sept. 13.

Utah, Brigham City—Box Elder Co. School Dist., general contract gymnasium, to Bird Finlayson, Pocatello, Idaho, $86,375; plumbing and heating, to Coleman & Sorenson, $19,450. **P.W.A.** J. Nelson, Provo, archt. Noted May 17.

Va., Blacksburg—Virginia Polytechnic Institute, general contract teaching and administration building, to J. A. Jones Constr. Co., Charlotte, N. C., $343,700***heating faculty dormitory, to R. H. Lowe, Inc., Roanoke, $15,239***electrical work, to Burgess Electric Co., Bluefield, W. Va., $10,602. Grand total $369,541. **P.W.A.**

†Wash., Almira—Bureau Reclamation, Dpt. Interior, Almira, general contract 30 cottages for model engineers town at Grand Coulee Dam, to McDonald & Gummere, Tacoma, $49,402. Bids Nov. 8. Noted Oct. 25.

†Wash., Almira—Bureau Reclamation, Dpt. Interior, constructing school at Government Camp at Grand Coulee Dam, 22 mi. northwest of here, to American Builders, Inc., 601 Alaska St., Seattle, $36,900. Bids Oct. 12. Noted Sept. 27.

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COMMERCIAL BUILDINGS

PROPOSED WORK

Ala., Birmingham—See "Contracts Awarded."

Conn., Norwich—Wm. W. Backus Hospital, 326 Washington St., plans by Chandler & Palmer, Thayer Bldg., brick, steel surgical unit. $105,000.

Conn., West Hartford—Mt. St. Joseph College, Right Rev. Thomas S. Duggan, 140 Farmington Ave., Hartford, plans by Maginnis & Walsh, Statler Bldg., Boston, Senior College group, 2 units now in progress, incl. administration offices, classrooms, dormitory section and science department, Asylum Ave. To exceed $150,000.

Ill., Chicago—Ledyward Realty Trust Co., State and Monroe Sts., plans altering air conditioning and heating for 5 story department store, State and Monroe Sts. To exceed $50,000. T. W. Grant, lessee, 1441 Bway., New York, will award the contracts.

N. J., Little Silver Twp.—J. W. Rowen and Clip Realty Corp., c/o H. London, 535 5th Ave., New York, plans group 200 dwellings, on 72 acre site, Sycamore Court, Monmouth Co. To exceed $100,000.

N. Y., Brooklyn—Brooklyn Polytechnic Institute, 85 Livingston St., sketches low cost housing project, 4th to 5th Sts. and 4th to 5th Aves. $2,000,000. P.W.A. project. Private plans, C. Potts, 15 William St., New York, in charge. Noted Nov. 15.

N. Y., Brooklyn—Brooklyn Ridgewood Corp., 6th Ave. and 50th St., bids after Jan. 1, 2 story, 92x144 ft. theatre, 5th Ave. near 50th St. $250,000. T. W. Lamb, 701 7th Ave., New York, archt. Noted Aug. 9.

N. Y., Brooklyn—Corporation, c/o W. Robb, 465 East 95th St., plans by Kavy & Kavovitt, 16 Court St., 6 story, 80x84 ft., brick apartment, plain found., 52nd St. and 15th Ave. $125,000.

N. Y., Brooklyn—R. L. Goetz, Inc., 311 Marine Ave., plans by J. Gabatchnik, 1838 West 5th St., plans 6 story, brick apartment, 94th St. and Marine Ave. $160,000.

N. Y., Brooklyn—Nostrand Flatbush Corp., 6th Ave. and 50th St., bids after Jan. 1 or later, 120x185 ft. store and theatre, Nostrand Ave. and Avenue H. $250,000. T. W. Lamb, 701 7th Ave., New York, archt. R.K.O. Theatres, 6th Ave. and 50th St., New York, lessee. Noted Aug. 16.

N. Y., Brooklyn—Kings Highway Theatre Corp., 6th Ave. and 50th St., New York, bids after Jan. 1, theatre, Ocean Ave. and Kings Highway. $250,000. T. W. Lamb, 701 7th Ave., New York, archt. R.K.O. Theatres, 6th Ave. and 50th St., New York, lessee. Noted Aug. 23.

N. Y., New York—City Theatre, 114 East 14th St., plans by T. W. Lamb, 701 7th Ave., altering air conditioning and mechanical equipment in theatre, 114 East 14th St. $28,000.

N. Y., New York—Annie Hasseit, 50 Riverside Dr., plans by L. and L. Levy, 527 5th Ave., altering elevator, plumbing and heating in 7 story apartment, 230 West 10th St. $40,000.

N. Y., New York — Corporation, c/o A. Cuttler, 1465 Bway., plans by DeYoung & Moscowitz, 205 East 42nd St., 2 story, basement, 80x100 ft., store, storage, office and loft building, 42nd St. and 3rd Ave. Est. about $100,000.

N. Y., New York—City Theatre, 114 East 14th St., bids after Jan. 1, air conditioning theatre, 114 East 14th St. To exceed $28,000. T. W. Lamb, 701 7th Ave., New York, archt. Noted Nov. 15.

N. Y., New York—Corporation, c/o Nichthauser, 108 East Clark Pl., plans by L. and L. Levy, 527 5th Ave., altering heating, plumbing in apartment, 107 West 82nd St. $30,000 or more.

N. Y., New York—Gerry Estates, 270 Bway., plans 3 story, 100x131 ft., brick store and office, 7th Ave. and 42nd St. To exceed $150,000. Rialto Times Square, Inc., c/o White, Lonis, Wanderstock & Co., 33 West 42nd St., lessee. Architect not appointed.

Pa., Luzerne—Luzerne National Bank plans bank. Est. about $100,000. Architect not appointed.

BIDS ASKED

N. Y., New York—See "Contracts Awarded."

CONTRACTS AWARDED

Ala., Birmingham—Birmingham Homesteads, Inc., Palmer Crossing, 60 dwellings, at Palmer Crossing, vicinity of here, to C. W. Hardy, Birmingham, $120,000. Owner also plans 260 additional dwellings, maturity later.

Me., Ellsworth — First Methodist Episcopal Church, C. O. Turner, chn. Building Com., general contract 2 story, basement, auditorium church, to W. H. McPherson, 22 Hodsdon St., Bangor. Noted Nov. 30, 1933.

N. Y., New York—Annie Hasseit, 50 Riverside Dr., altering heating, plumbing and elevator in 7 story apartment, 230 West 101st St., to Newman Loeb Constr. Co., 1 West 34th St. Est. $40,000. L. and L. Levy, 527 5th Ave., archts. Noted Nov. 15.

N. Y., New York—Landboro Realty Corp., 341 East 149th St., altering heating and plumbing in two 4 story apartments, 333 East 69th St., separate contracts, $28,000. Sampson & Levy, 341 East 194th St., archts. Noted Nov. 15.

N. Y., New York — Metropolitan Life Insurance Co. will award general contract about Dec. 1 from bids submitted by selected list of bidders altering ventilating and heating apartments, 1 West 30th St. $35,000. D. E. Waid, 1 Madison Ave., archt. Noted Nov. 15.

N. Y., New York—I. Nichtauser, 108 Clark Pl., altering heating, plumbing in apartment, 16 St. Marks Pl., separate contracts, $30,000. L. and L. Levy, 527 5th Ave., archts. Noted Nov. 15.

R. I., Providence—St. Casimir's Lithuanian Parish, 349 Smith St., J. A. Vaitekunas, pastor, general contract 1½ story, basement, 60x90 ft. church, Smith St., to L. A. Murphy, 112 North Bend St., Pawtucket***heating, to J. F. Martin Plumbing & Heating Co., Inc., 286 East Ave., Pawtucket***plumbing, to Joseph P. Cuddigan, 938 Bway., East Providence***electrical work, to Scannevin & Potter, 189 Pine St. Noted Feb. 1.

INDUSTRIAL BUILDINGS

PROPOSED WORK

Ark., Caraway—PLANT—Allen Cooperage Co. plans wood products plant, to replace recently burned plant. $40,000 or more. **Maturity indefinite.** Architect not appointed.

California — MINING DEVELOPMENT — Tahoe Treasure Consolidated Mines, c/o H. C. Winslow, Bend, Ore., plans developing mining properties, vicinity Lake Tahoe. To exceed $30,000.

Ky., Campbell — PLANT — Campbellsville-Cooperage Co. bids after Apr. 1, keg and barrel plant. $30,000 or more.

Minn., St. Paul—SERVICE and DISTRIBUTION PLANT—Goodrich Tire Co., Akron, O., and 176 West 6th St., St. Paul, plans altering and repairing service and distribution plant. To exceed $30,000. Architect not appointed.

Montana—GOLD MINING DEVELOPMENT—Virginia City Mining Co., F. R. Scott, pres., Fargo, N. D., plans gold mining development at undisclosed locations. To exceed $200,000 with equipment.

N. M., Carrizozo—MINING DEVELOPMENT—Real Del Monte Metals Co., C. E. Degner, pres., plans developing mining properties, near here. To exceed $150,000.

N. Y., Junius — PLANT — B. E. Babcock, Junius and Geneva, plans rebuilding sauerkraut manufacturing plant, recently destroyed by fire. $30,000 ro more. **Maturity 1935.** E. Dhalle, Phelps, engr. Architect not appointed.

N. Y., New York—STORAGE, etc.—E. Higgins, 50 Union Sq., bids in February or later, storage and service building, 604 West 43rd St., $120,000. Mack Truck Corp., 25 Bway., New York, lessee. Noted Nov. 8.

N. Y., Patchogue — WAREHOUSE, etc.—Colonial Beacon Oil Co., 155 East 44th St., New York, plans by C. T. Paul, 155 East 44th St., New York, warehouse, storage tanks, and office. To exceed $50,000.

O., Chillicothe—SERVICE STATIONS—Sinclair Refining Co., 45 Nassau St., New York, N. Y., plans group service stations and repair shops at 5th and Paint Sts., and at other locations in vicinity of here. To exceed $30,000.

Ont., Alexandria—COLD STORAGE PLANT—Cheese Factory Patrons Assn., A. McGillis, chn. Com., plans cold storage plant. $100,000.

BIDS ASKED

Calif., Hermosa Beach—STORAGE, etc.—See "Contracts Awarded."

Calif., San Francisco — WAREHOUSE — San Francisco Warehouse Co., 3rd and Brannan Sts., taking bids 4 story, 55x317 ft., brick, rein.-con. addition, Brannan St. near 3rd St. Ellison & Russell, Pacific Bldg., engrs.

Ind., Indianapolis—PLANT—See "Contracts Awarded."

N. Y., New York—STORAGE—See "Contracts Awarded."

N. Y., Yonkers—MARKET—See "Contracts Awarded."

O., Cincinnati—BULK OIL PLANT—J. D. Whitmore, engr., c/o Sun Oil Co., Woodville St. and Belt Ry., Toledo, taking bids general and separate contracts bulk oil plant, 2408 Riverside Dr., for Sun Oil Co., 1608 Walnut St., Phila., Pa. Est. $30,000 or more.

Ont., Hamilton—WAREHOUSE—Steel Co. of Canada, Wilcox St., taking bids foundation and structural steel for 1 story addition to Warehouse 2, lean-to addition to Warehouse 2 and small addition to charging mill and cut-bar building, Wilcox St. $125,000. Private plans.

CONTRACTS AWARDED

Calif., Fillmore—PACKING PLANT, etc.—Fillmore Citrus Assn., 100x186 ft. packing plant, and 40x300 ft. box storage shed, to Rainey & MacIsaac, 6624 Stanford Ave., Los Angeles. $55,509. Awarded Nov. 6. Noted Nov. 15.

Calif., Hermosa Beach—STORAGE, etc.—Patten-Blinn Lumber Co., 606 Pier Ave., rebuilding storage and lumber yard, day labor and separate contracts. Est. $28,000.

Ind., Indianapolis—PLANT—Abbatoir Packing Co., 1220 Drover St., altering plant, 1220 Drover St., own forces. $28,500. Private plans.

Ind., Indianapolis—FACTORY—Bowes Seal Fast Corp., 226 North Pine St., general contract 2 story, basement factory additions, 226 North Pine St., to S. P. Goss, 710 Laverock St. Est. $28,500.

Ind., Indianapolis—PLANT—Riverview Packing Co., altering and constructing plant additions, Kentucky and McCarthy Sts., own forces. $28,500.

Ind., Indianapolis—FACTORY—Inland Container Corp., 700 West Morris St., 1 story, 85x281 ft., brick, steel, Morris and Dakota Sts., to W. P. Jungclaus Co., 825 Mass. Ave. Est. $39,700. Noted Jan. 4.

Ind., Terre Haute—PLANT—Owens Illinois Glass Co., 965 Wall St., Toledo, O., plant addition, to G. W. North Co., 9th St. Est. $75,000.

Ky., Louisville — DISTILLERY — Joseph & Joseph, archts., Breslin Bldg., general contract complete distillery units, Dixie Hy., to A. Markham & Co., 432 South Floyd St., for Stitzel Weller Distillery Co., 1033 Story Ave. To exceed $150,000.

Md., Baltimore—CORK STORAGE SHED—L. R. White, Jr., archt., 10 West Chase St., 1 story, 80x300 ft., cork storage shed and breaker house, 4 story, 130x150 ft. building, for Crown Cork & Seal Co., Eastern Ave. and Kresson St., to Consolidated Eng. Co., 20 East Franklin St., $87,000. Noted Nov. 8.

Md., Baltimore—BREWERY—Globe Brewery, 327 South Hanover St., 4 story, brick, concrete addition, to Price Constr. Co., Maryland Trust Bldg., $38,000. Bids Sept. 15. Noted Sept. 13.

Md., Baltimore—PLANT—Goodyear Tire & Rubber Co., 1144 East Market St., Akron St., Akron, O., 2 story, brick master tire and service station on foundations (now under contract) to W. E. Bickerton Constr. Co., 515 Cathedral St., $91,000. Bids Oct. 31, awarded Nov. 15. Noted Nov. 1.

Mich., Yale—FACTORY—Yale Woolen Mills, 1 story, 120x305 ft. woolen goods factory, brick, rein.-con. steel, plain found., to Austin Co., 2-248 General Motors Bldg., Detroit. Est. $50,000. Austin Co., 2-248 General Motors Bldg., Detroit, archts.

N. Y., New York—STORAGE WAREHOUSE—Baltimore & Ohio R.R. Co., H. A. Lane, ch. engr., Baltimore, Md., storage warehouse addition, 602 West 26th St., to Austin Co., 19 Rector St. Est. $28,000. Contractor has awarded separate contracts. Noted Nov. 8.

N. Y., New York—STORAGE, etc.—Belvedere Estates, 690 8th Ave., New York, altering storage, loft and printing, separate contracts. $35,000. Owner now taking bids. T. W. Golding, 607 5th Ave., archt. Noted Nov. 15.

N. Y., New York—STORAGE and STORE—General Society of Mechanics & Tradesmen, 16 West 44th St., heating plant for storage and stores, 30 Crosby St., to O'Sullivan & Harney Co., 110 East 42nd St., New York. Est. $28,000. Noted Nov. 8.

N. Y., New York—STORAGE—Museum Estates, Inc., 14 Wall St., altering two buildings 3 story, and 19 story, brick, steel, 170 Nassau St., separate contracts. $40,000. Will take bids after Dec. 1. W. O. Hohauser, 1841 Bway., archt. Noted Nov. 15.

N. Y., New York—WAGON STORAGE—Borden's Farm Products Co., 110 Hudson St., wagon storage, 218 West 130th St., to McCaffery Constr. Co., 218 West 130th St. Est. $28,000. Noted Nov. 8.

N. Y., Utica—BREWERY—Pierce Jones, general contractors, 618 Charlotte St., Buffalo, 165 tons structural steel for brewery, to Ernst Iron Wks., Inc., 75 Lathrop St., Buffalo, for West End Brewing Co., Utica. Noted Oct. 11, under "Contracts Awarded."

N. Y., Yonkers—MARKET—Emigrant Industrial Savings Bank, 51 Chambers St., New York, altering refrigeration in market, 614 South Bway., separate contracts, $28,000 with equipment. Great Atlantic & Pacific Tea Co., 420 Lexington Ave., New York, lessee.

N. C., Graham—MILL—Jos. R. Morton & Co., silk mill addition, to C. M. Guest & Sons, Anderson. Est. $100,000.

Ont., East Windsor—FOUNDRY—Ford Motor Co. of Canada Ltd., W. Campbell, genl. mgr., 125x225 ft. brick foundry, to Allen Constr. Co., 24 Wyandotte St.; steel, to Canadian Bridge Co., Walkerville. Est. $400,000, incl. equipment. Noted Nov. 15.

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†*Federal Government.*